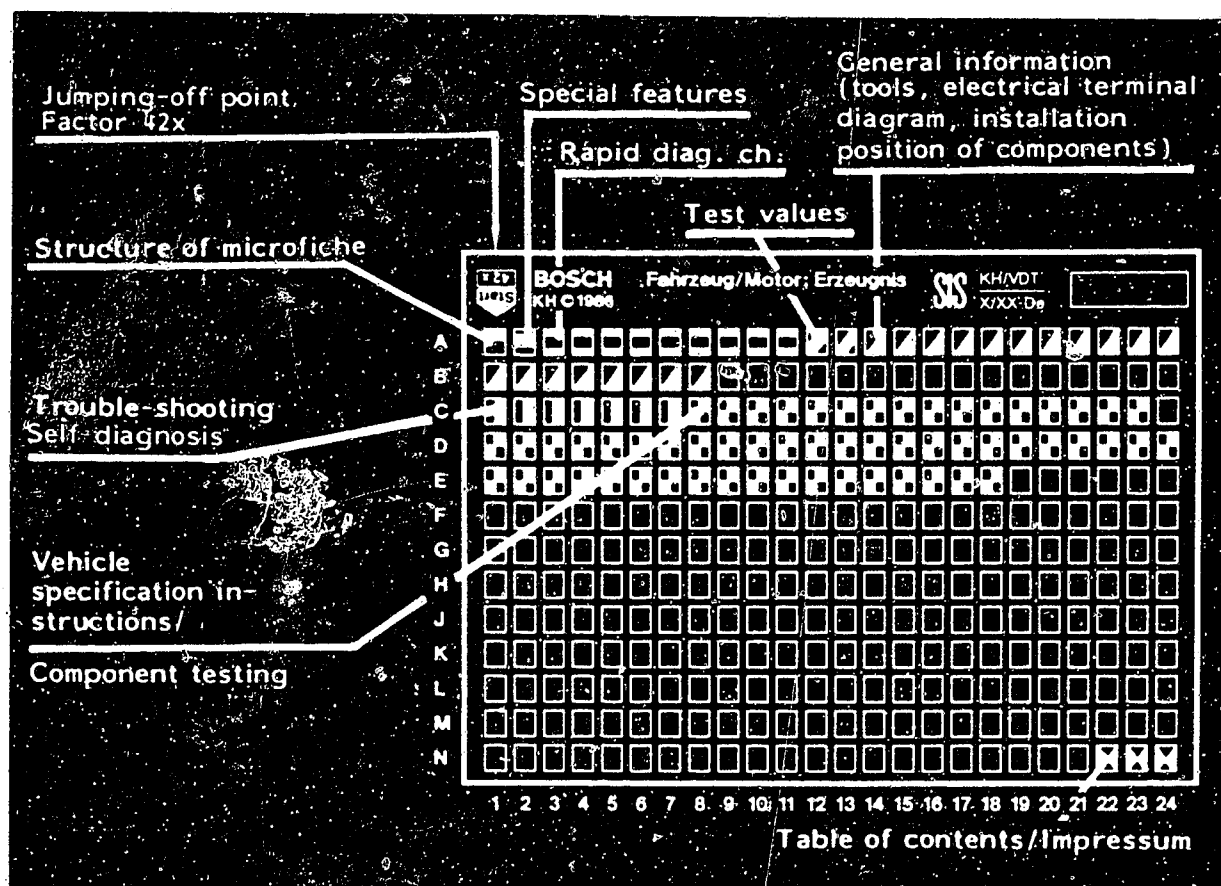


Structure of microfiche

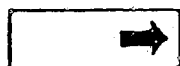


1. Read from left to right
2. Title of microfiche (appears on each coordinate)

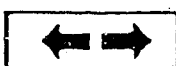
| | |
|------------|-----------------------------|
| E16 | Product/component/test step |
| | Vehicle/engine |

Coordinate

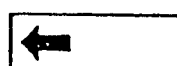
3. Limits of section



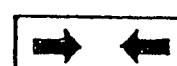
Beginning



Mid-section



End



One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

A1

Trouble-shooting chart



1. Special features

Microcard with trouble-shooting instructions for the engine control system (EEC IV) from Ford (characteristic-map ignition and gasoline injection as with Motronic), valid at the time of publication, for the following Ford models:

Ford Sierra 2.0 i (04.85 →)

Ford Scorpio 2.0 i (04.85 →)

New functions in this vehicle:

- Limited self-diagnosis
- Crankshaft speed and position is detected via "Hall generator" (engine-speed and reference-mark sensors not present)
- External ignition module
- Exhaust-gas recirculation (EGR) and secondary air injection (Pulsair) for version for Sweden (S)/Switzerland (CH).
- Restricted operating program (LHS and LOS) in the case of a fault in the measured-value sensor circuit (e.g. air-flow sensor) or control unit.



2. Rapid diagnosis chart

The rapid diagnosis chart beginning at coordinate A04 makes it possible for the experienced expert to quickly check the system using the necessary test equipment and aids.

The rapid diagnosis chart contains the test step sequence, components tested, test instructions and test specifications.

If detailed data and instructions are required, always proceed in accordance with trouble-shooting for "customer complaints" and component testing starting at coordinate C01.

Note:

Self-diagnosis with flashing code table starts at coordinate C05.

Test requirement:

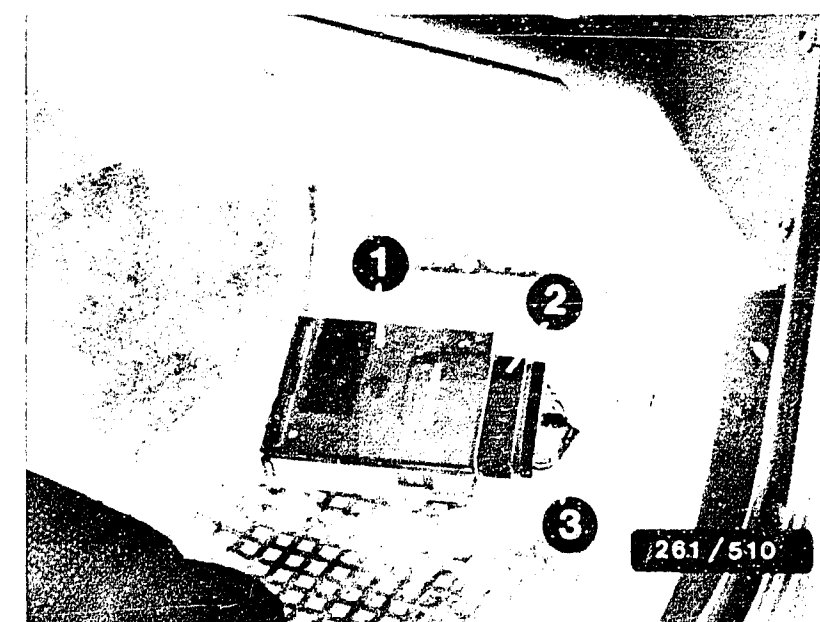
Engine mechanically O.K. (e.g. compression, valve clearance etc.).

Switch off the ignition before disconnecting plug connections.



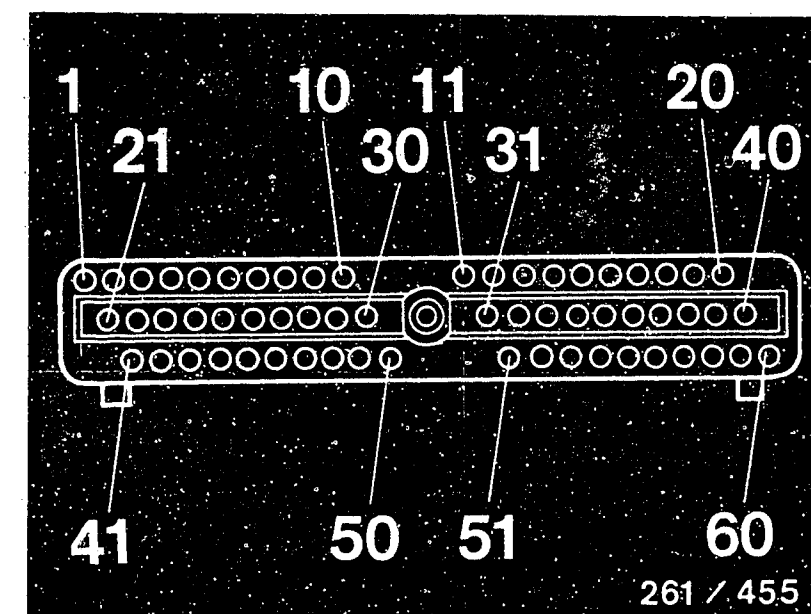
Rapid diagnosis chart

| Test step | Measuring range | Components and/or relevant cables tested. Remarks | Control-unit plug between terminal | Test specifications (reading) |
|-----------|-----------------|--|---|--|
| 1 | Ω | Ignition off. Unscrew control-unit plug (upper illustration). Measure resistance at plug (lower illustration). | 20 \leftrightarrow vehicle ground | Smaller than 1 Ω |
| 2 | Ω | Negative supply, control unit | 40/60 \leftrightarrow battery (-) | Each smaller than 0.5 Ω |
| 3 | Ω | Disconnect plug for octane/idle adjustment (if connected). Measure resistance at control-unit plug. Yellow cable (5) \rightarrow idle adjustment Red (23) and blue (24) cable \rightarrow \rightarrow spark-advance adjustment | 5 \leftrightarrow ground (S/CH: 3 \leftrightarrow ground) 23 \leftrightarrow ground 24 \leftrightarrow ground | Greater than 1 M Ω |
| 4 | Ω | Selection lever and relevant cable for automatic transmission: | 30 \leftrightarrow 40 | Pos. P, N: ∞ Ω Pos. D: smaller than 20 Ω |
| | | For manually shifted transmission: | | ∞ Ω |
| 5 | Ω | Engine temperature sensor and relevant cables | 7 \leftrightarrow 46 | Engine cold: 20...100 k Ω Engine at norm. op. temp.: 2...10 k Ω |
| 6 | Ω | Air-flow sensor | 43 \leftrightarrow 46 (S/CH: 27 \leftrightarrow 46) | 50...100 Ω |
| | | | 26 \leftrightarrow 43 | 480...600 Ω |



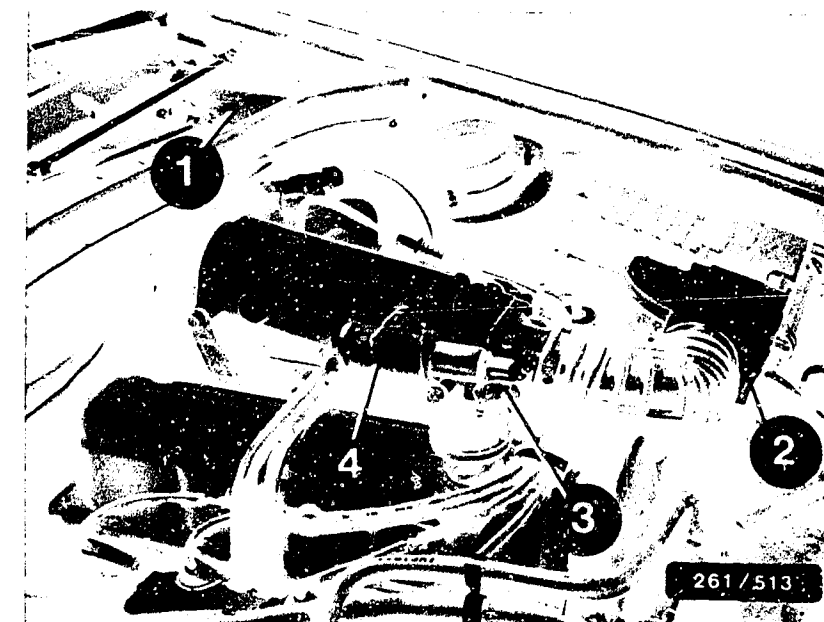
- 1 = EEC IV control unit
- 2 = Control-unit plug (60-pin)
- 3 = Fastening screw for control-unit plug

60-pin EEC IV control-unit plug (top view)



Rapid diagnosis chart (continued)

| Test step | Measuring range | Components and/or relevant cables tested. Remarks | Control-unit plug between terminal | Test specifications (reading) |
|-----------|-----------------|---|------------------------------------|--|
| 7 | Ω | Intake-air temperature sensor at 15...30°C: | 25 <--> 46 | 1.45...3.3 k Ω |
| 8 | Ω | Throttle-valve potentiometer | 47 <--> 46 47 <--> 26 | 600...750 Ω 950...1200 Ω |
| 9 | Ω | Idle actuator | 37 <--> 21 | 8...16 Ω If test spec. below tolerance, reverse polarity of instrument lead. |
| 10 | Ω | Injection valves: cylinders 1 and 2 (parallel) | 37 <--> 58 | 7...11 Ω |
| 11 | Ω | Injection valves: cylinders 3 and 4 (parallel) | 37 <--> 59 | 7...11 Ω |
| 12 | Ω | Pump relay (winding) | 37 <--> 22 | 50...120 Ω |
| 13 | Ω | Ground connection, ignition module | 16 <--> 40 | Smaller than 1 Ω |
| 14 | Ω | Only in S/CH: vacuum converter | 37 <--> 52 | Approx. 100 k Ω |
| 15 | Ω | If term. 51 assigned: secondary-air solenoid-operated valve | 37 <--> 51 | 60...80 Ω |
| 16 | Ω | Cables: voltage supply, control unit | 37 <--> 57 | Smaller than 1 Ω |



- 1 = Fuse and relay box
- 2 = Air-flow sensor
- 3 = Throttle-valve potentiometer
- 4 = Idle actuator

Arrows = Injection-valve plug



A6

Rapid diagnosis chart
Ford



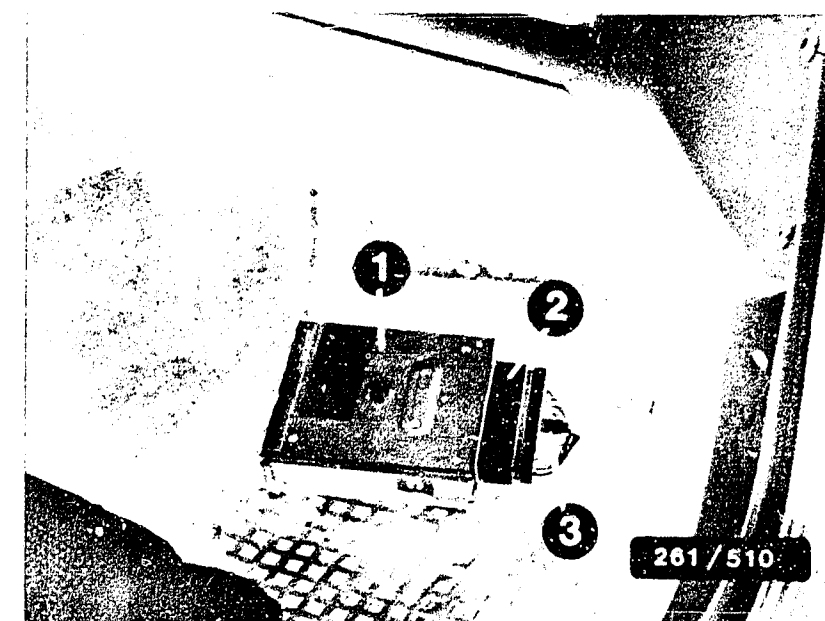
A7

Rapid diagnosis chart
Ford



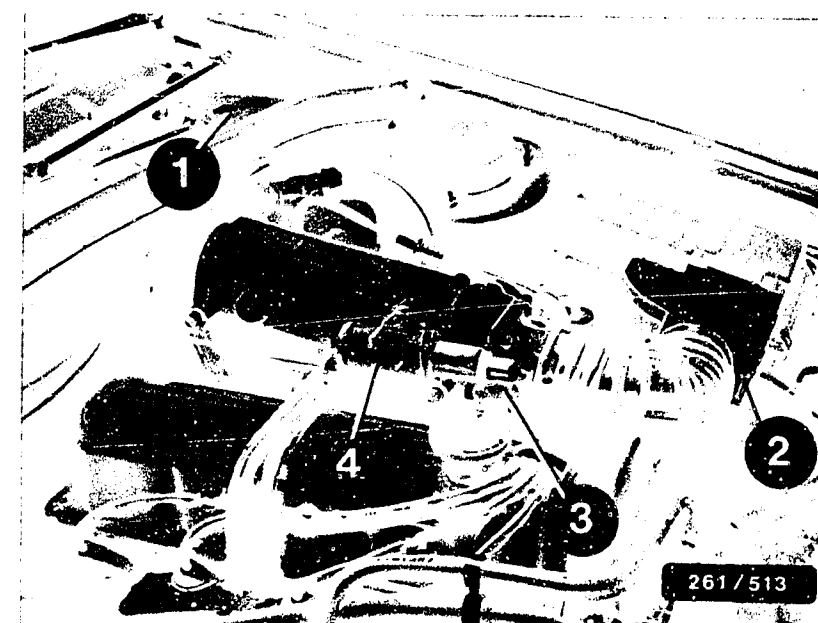
Rapid diagnosis chart (continued)

| Test step | Measuring range | Components and/or relevant cables tested. Remarks | Control-unit plug between terminal | Test specifications (reading) |
|---|-----------------|---|------------------------------------|--|
| Reconnect control-unit plug. Switch on ignition. Measure voltage at back of plug. | | | | |
| 17 | V | Main relay. Voltage supply for control unit | 37 <-> ground | 10...14 V |
| 18 | V | Voltage supply, air-flow sensor and throttle-valve potentiometer | 26 <-> 46 | Greater than 4.5 V |
| 19 | V | Air-flow sensor tap Deflect air-flow sensor flap slowly as far as will go: | 43 <-> 46 (S/CH: 27 <-> 46) | 0.2...0.3 V Voltage rises up to at least 4.2 V |
| 20 | V | Throttle-valve potentiometer tap, slowly accelerate | 47 <-> 46 | Approx. 0.6...0.7 V Voltage rises up to approx. 4.5 V |
| 21 | V | Voltage supply, idle actuator | 21 <-> ground | 10...14 V |



- 1 = EEC IV control unit
- 2 = Control-unit plug (60-pin)
- 3 = Fastening screw for multiple plug

- 1 = Fuse and relay box
- 2 = Air-flow sensor
- 3 = Throttle-valve potentiometer
- 4 = Idle actuator



A8

Rapid diagnosis chart

Ford



A9

Rapid diagnosis chart

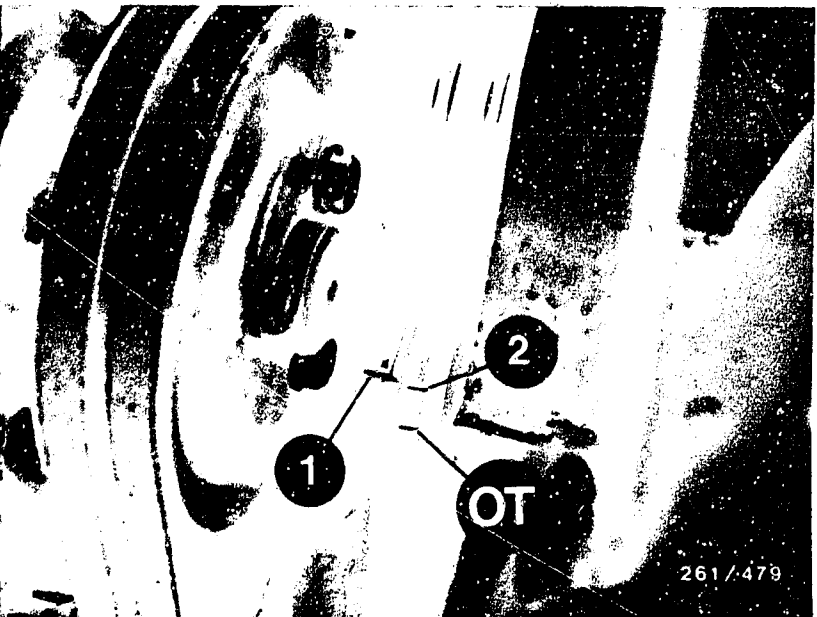
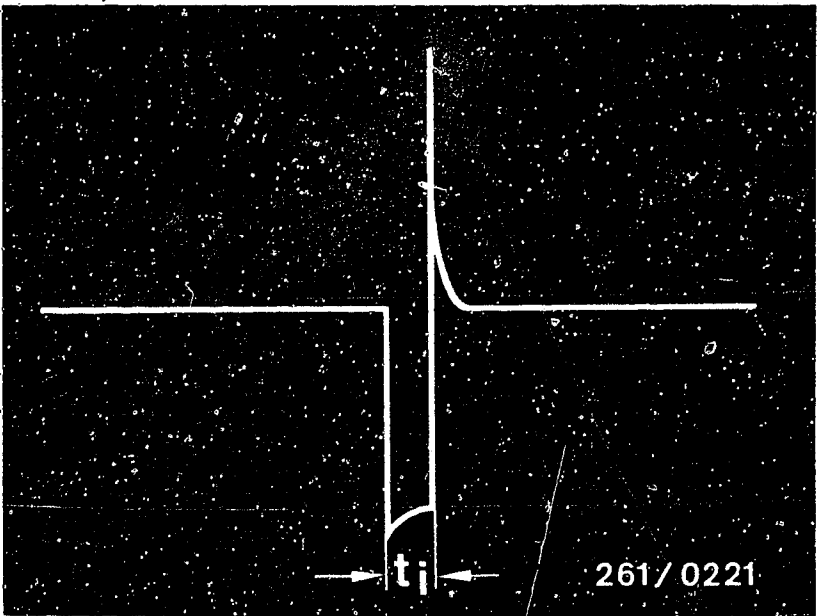
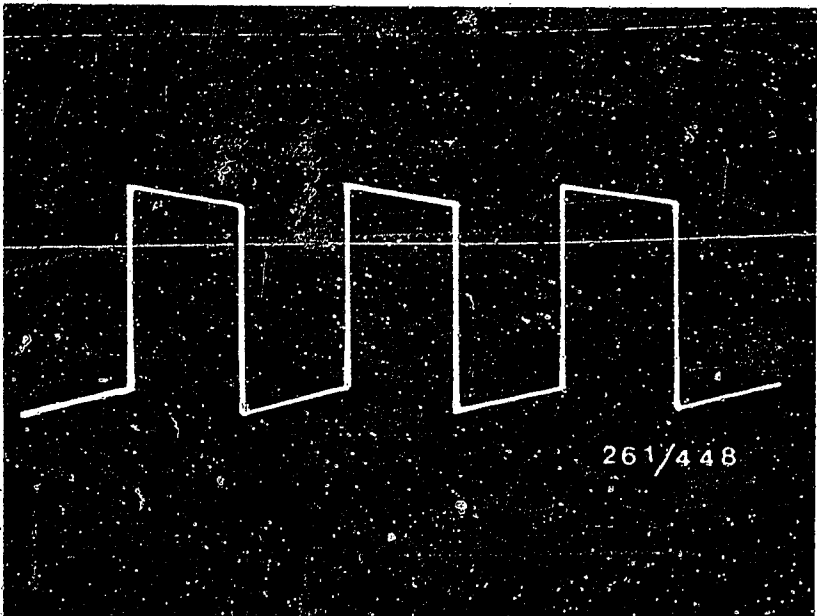
Ford



Rapid diagnosis chart (continued)

| Test step | Measuring range | Components and/or relevant cables tested. Remarks | Control-unit plug between terminal | Test specifications (reading) |
|-----------|-----------------------------|---|------------------------------------|--|
| 22 | V | Fuel-pump relay and control unit (pump control) | 22 <-> ground | 10...14 V with engine running: max. 4 V |
| 23 | V | Air-conditioner coupling (if present) | 10 <-> ground | Approx. 0 V Switch on air conditioner: 10...14 V |
| 24 | Oscilloscope, special input | Hall generator, ignition module: Control unit: Start engine | 56 <-> 37 36 <-> 37 | See upper illustration |
| 25 | Oscilloscope, special input | Control unit: injection signal for cylinders 1 and 2 Start engine. | 58*<-> ground | See center illustration |
| 26 | Oscilloscope, special input | Control unit: injection signal for cylinders 3 and 4 Start engine. | 59*<-> ground | See center illustration |
| 27 | Motor-tester, timing strobe | Spark advance at idle: (basic setting) Engine at normal operating temperature, consuming devices switched off, idle speed smaller than 900 min ⁻¹ . | Cylinder 1 | 7°...17° before TDC See lower ill. Item 2 = Ignition marking Item 1 = Fixed mandrel |

* Alternatively test directly at the injection valve using test lead 1 684 463 093.



3. Test specifications

The test specifications given are valid for measurements taken directly at the components. When measuring resistances, disconnect plug to component.

- Idle speed

| | |
|-------------------------------|-----------------------|
| Manually shifted transmission | 875 min ⁻¹ |
| Automatic (in N, P) | 800 min ⁻¹ |

- Spark advance at idle
(Basic setting) 12° before TDC

- CO content at idle
(Engine at normal operating temperature) 0.5...1.0% by vol.

- Fuel pressure 2.3...2.7 bar

- Electric fuel pump

| | |
|------------------------------------|-----------------------------------|
| Fuel delivery (measured in return) | at least 750 cm ³ /30s |
| at connection voltage (under load) | at least 12 V |

- Solenoid-operated injection valve

| | |
|--------------------------------|-------------|
| Internal electrical resistance | |
| at +15...+30°C | 15...17.5 Ω |

- Ignition coil

| | |
|----------------------|----------------|
| Primary resistance | 0.68...0.91 Ω |
| Secondary resistance | 4.30...7.30 kΩ |



Test specifications (continued)

● Air-flow sensor and temperature sensor

Internal electrical resistance

Term. 9 to term. 6

max. 2.5 k Ω

Term. 7 to term. 6

50...100 Ω

(Deflect air-flow sensor flap)

max. 2.1 k Ω

Term. 22 to term. 6 (NTC I)

at +15...30°C

1.45...3.3 k Ω

● Engine temperature sensor

Internal electrical resistance with

cold engine (+15...+30°C):

20...100 k Ω

warm engine (approx. +80°C):

2...10 k Ω

● Throttle-valve potentiometer

Internal electrical resistance:

Orange cable to black cable

3.2...4.8 k Ω

Green cable to black cable

Throttle valve closed

600...750 Ω

Throttle valve open

3.5...4.0 k Ω

● Idle actuator

Internal electrical resistance:

9...14 Ω

● Secondary-air solenoid-operated valve (if present)

Internal electrical resistance:

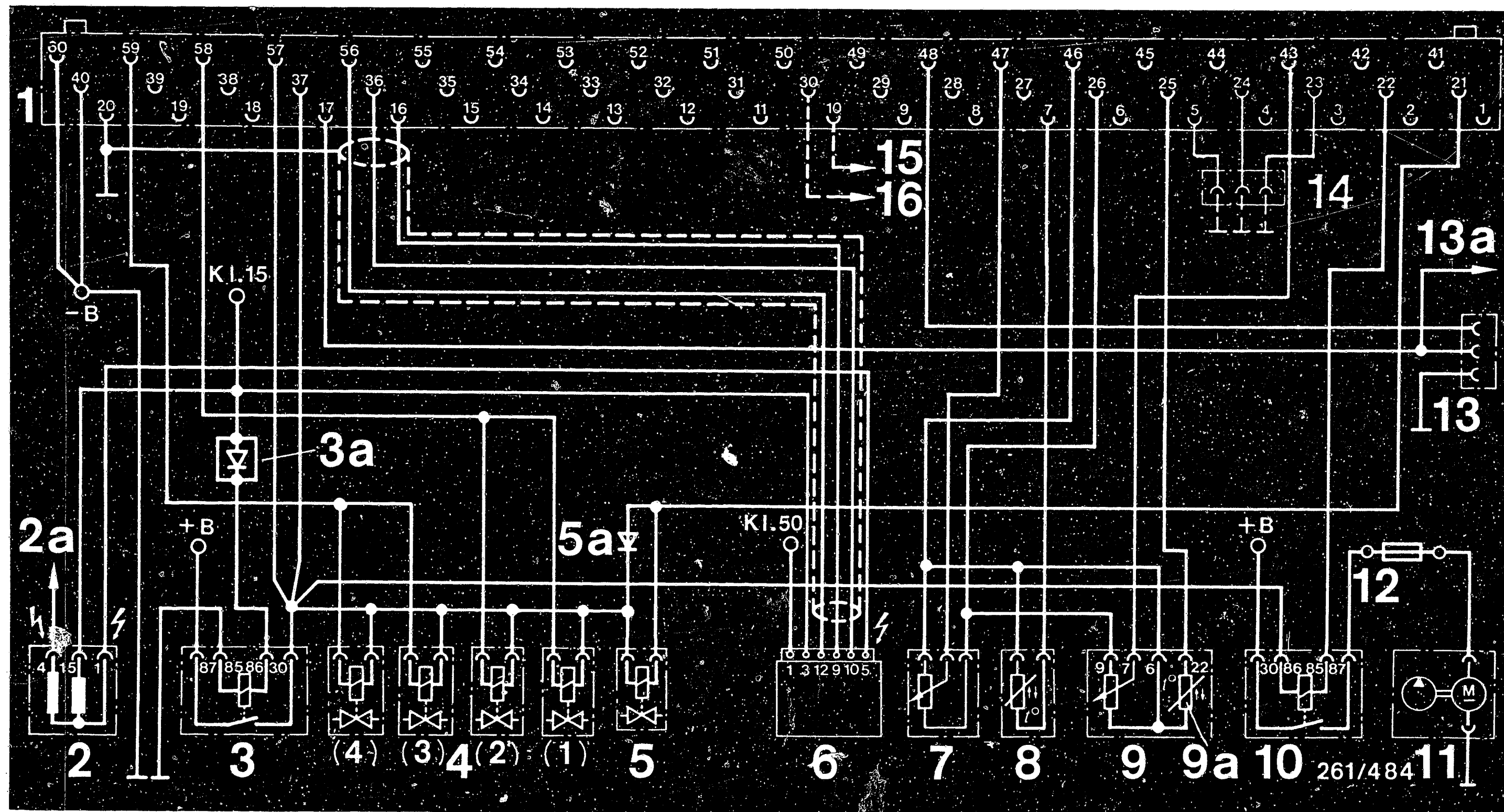
60...80 Ω

● Vacuum converter (S, CH)

Internal electrical resistance

approx. 100 k Ω





4. Electrical terminal diagram (vehicles without exhaust-gas recirculation)

- | | | |
|---|--|----------------------------------|
| 1 = EEC IV control unit | 4 = Solenoid-operated injection valves | 8 = Temperature sensor (coolant) |
| 2 = Ignition coil | 5 = Idle actuator | 9 = Air-flow sensor |
| 2a = to high-voltage distributor | 5a = Cutoff diode | |
| 3 = Main relay | 6 = Ignition module (TFI IV) | |
| 3a = Reversed-polarity protection diode | 7 = Throttle-valve potentiometer | |

A14

Electrical terminal diagram

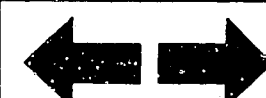
Ford

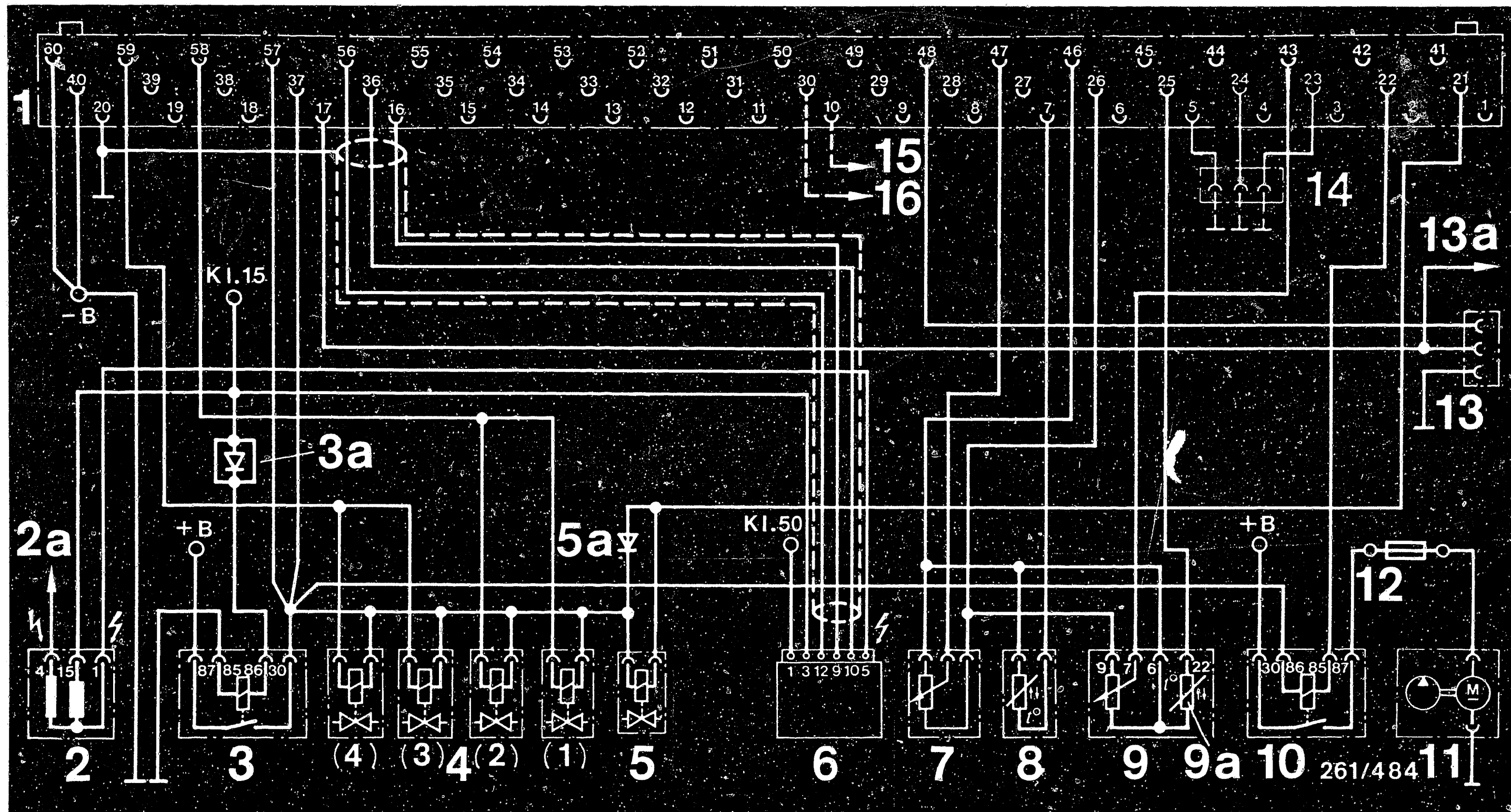


A15

Electrical terminal diagram

Ford





A16

Electrical terminal diagram

Ford

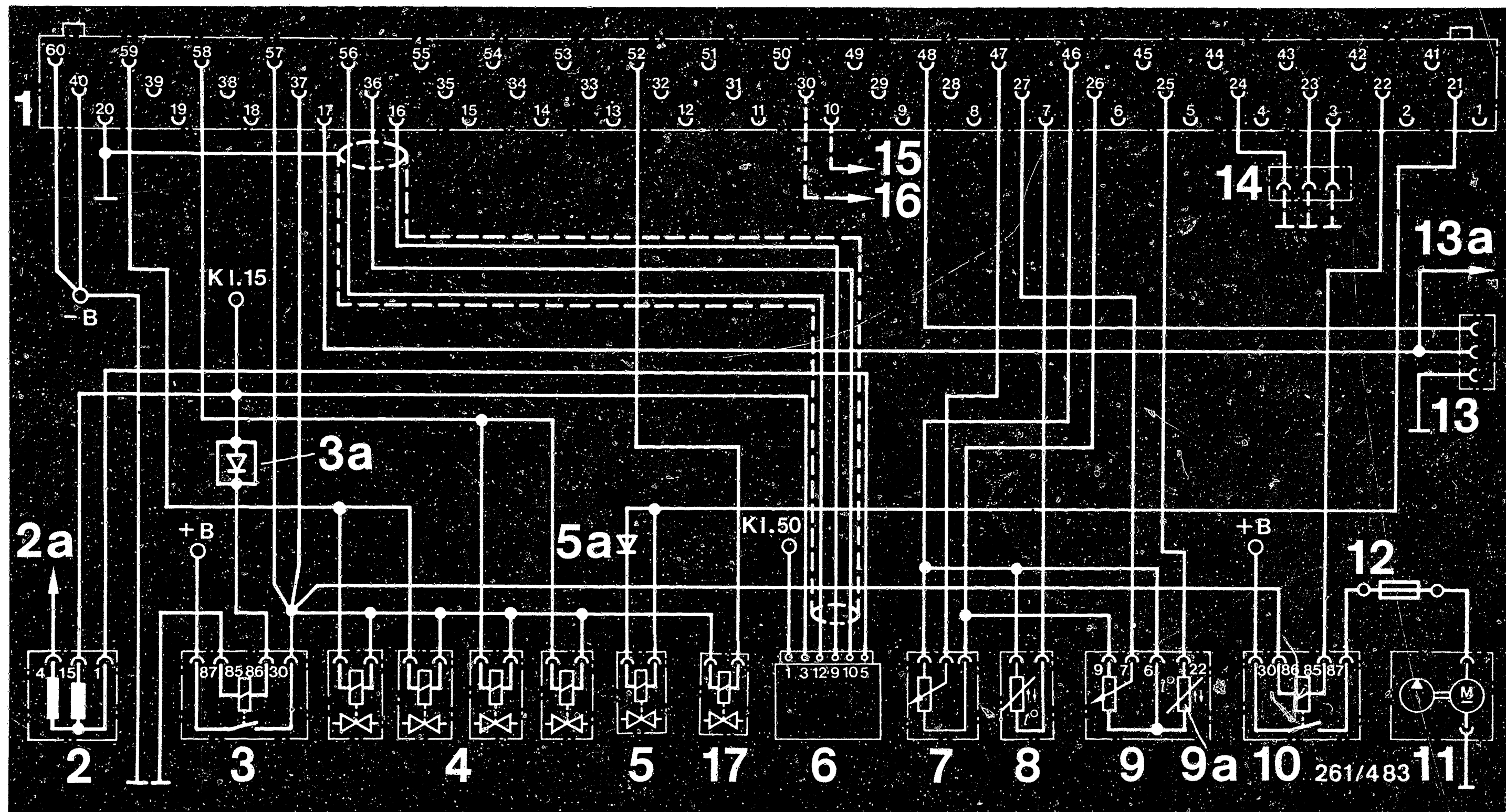


A17

Electrical terminal diagram

Ford





4.1 Electrical terminal diagram (vehicles with exhaust-gas recirculation; S/CH version)

- 1 = EEC IV control unit
- 2 = Ignition coil
- 2a = to high-voltage distributor
- 3 = Main relay

- 3a = Reversed-polarity protection diode
- 4 = Solenoid-operated injection valves
- 5 = Idle actuator
- 5a = Cutoff diode

- 6 = Ignition module (TFI IV)
- 7 = Throttle-valve potentiometer
- 8 = Temperature sensor (coolant)
- 9 = Air-flow sensor

A18

Electrical terminal diagram

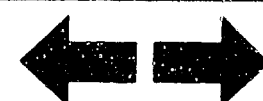
Ford

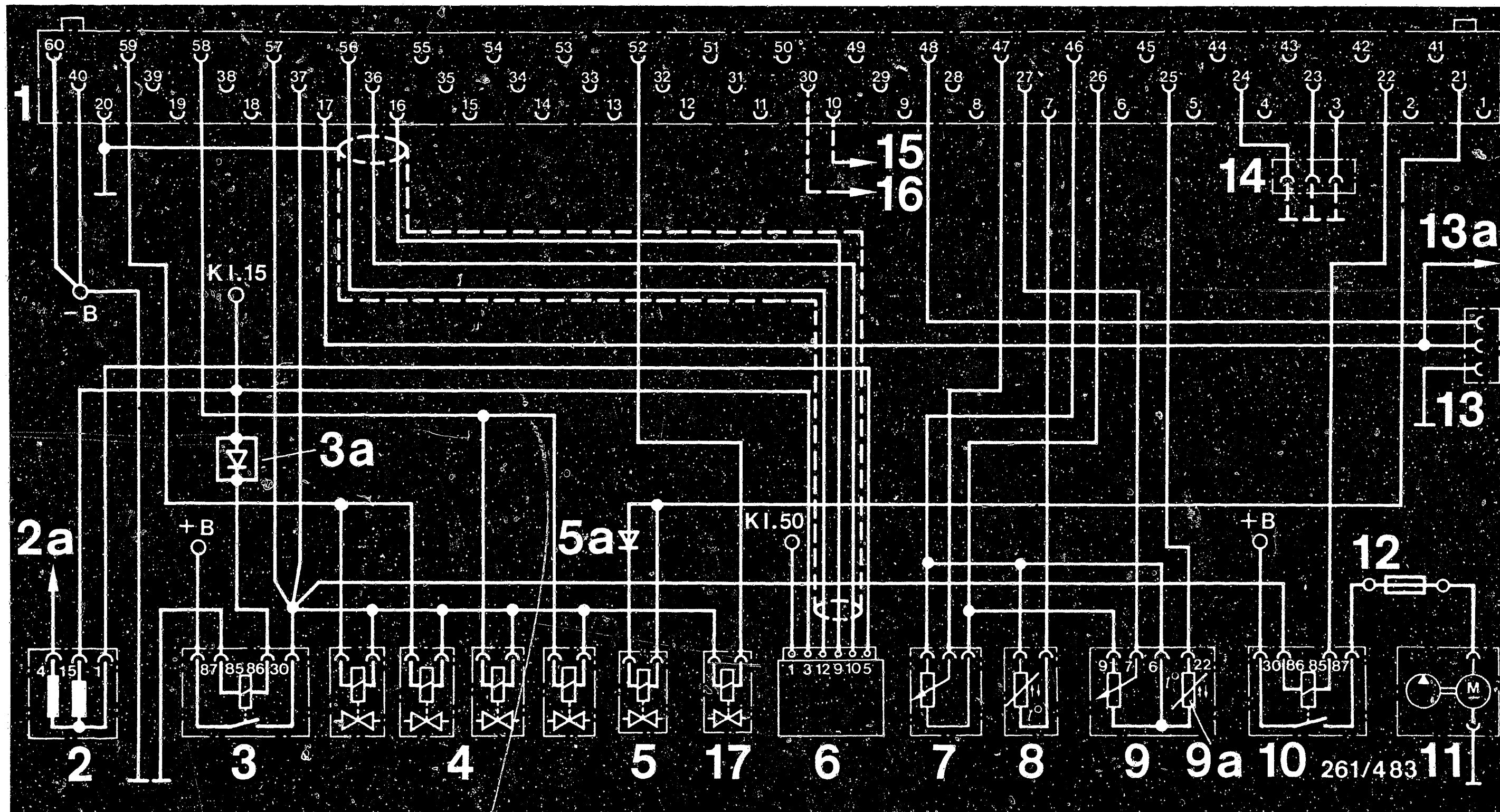


A19

Electrical terminal diagram

Ford





Electrical terminal diagram (vehicles with exhaust-gas recirculation; S/CH version) (continued)

9a = Temperature sensor (air)
 10 = Pump relay
 11 = Fuel pump

12 = Pump fuse (No. 30)
 13 = Self-diagnosis connection
 13a = Connection, fuel computer
 14 = Plug for octane/idle adjustment

15 = to magnetic coupling, air conditioner
 16 = Position switch (N/D switch; if automatic)
 17 = Vacuum converter

A20

Electrical terminal diagram

Ford

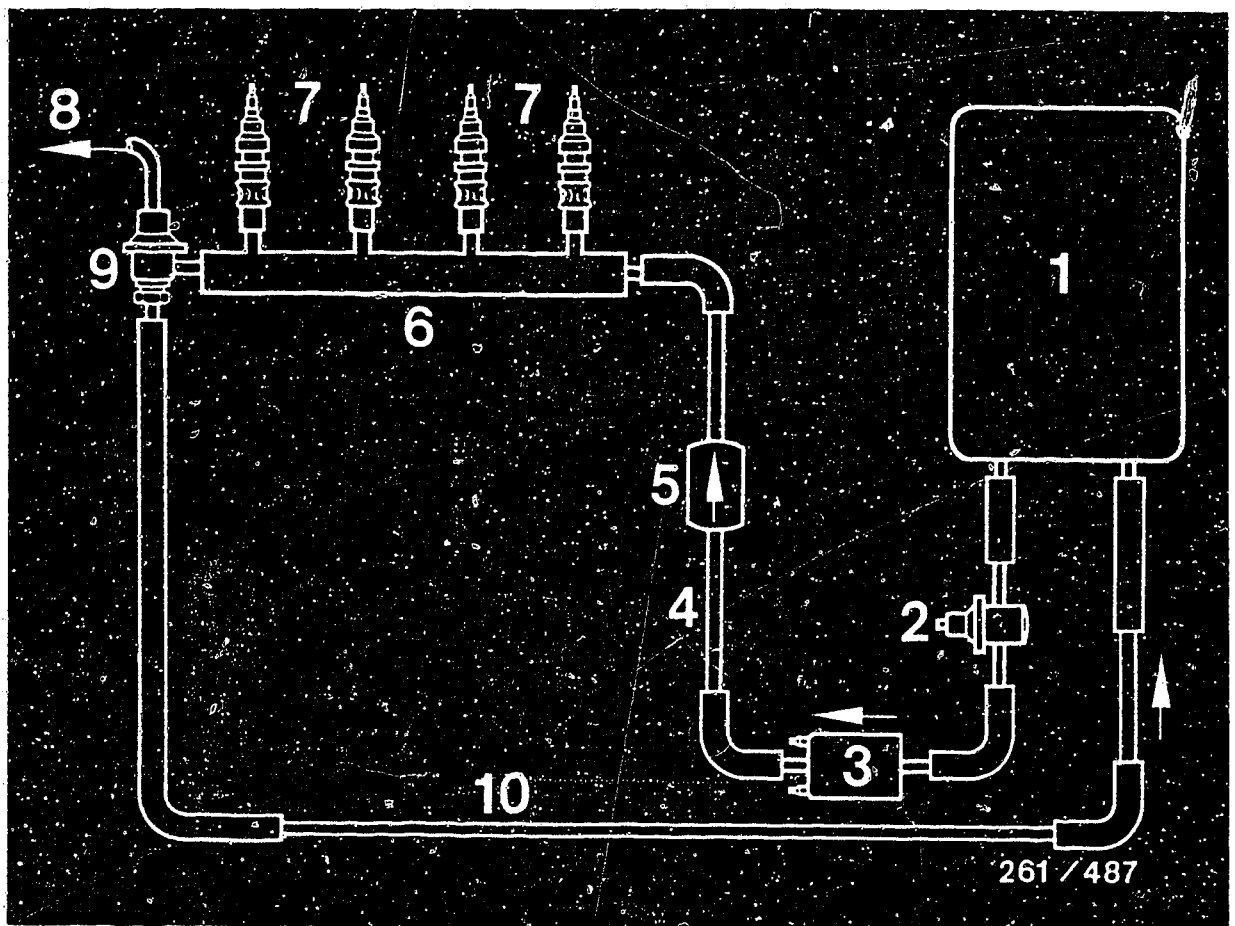


A21

Electrical terminal diagram

Ford





5. Diagram of fuel lines

- 1 = Fuel tank
- 2 = Fuel-line-pressure damper
- 3 = Electric fuel pump
- 4 = Fuel-pressure line
- 5 = Fuel filter
- 6 = Fuel-distribution pipe
- 7 = Solenoid-operated injection valves
- 8 = to intake manifold
- 9 = Pressure regulator
- 10 = Fuel-return line



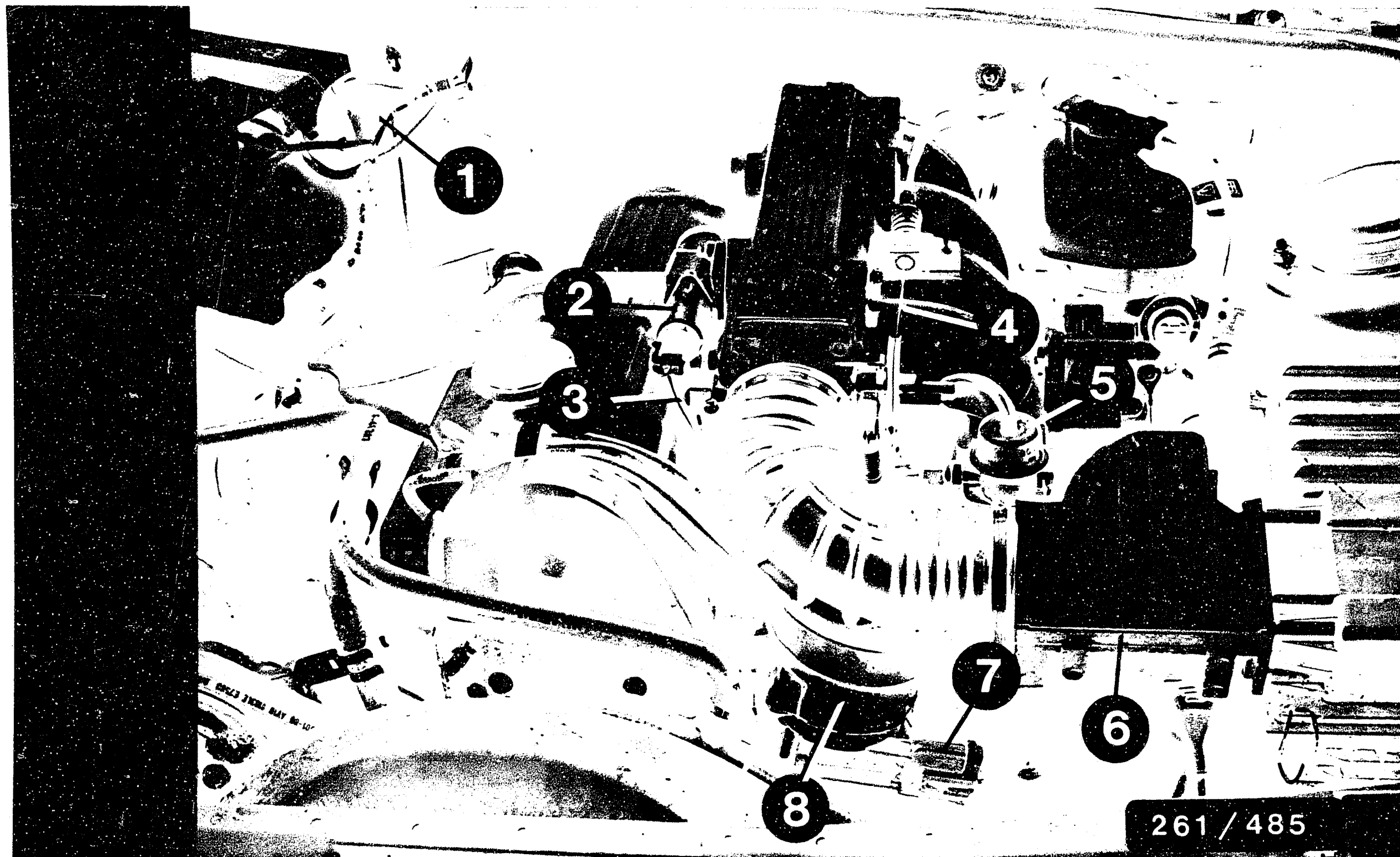
6. Test equipment and tools

| <u>Description</u> | <u>Designation</u> | <u>Part No.</u> |
|---|--|--|
| Motortester | e.g. MOT 201 or MOT 300 and MOT 400 | 0 684 000 201 0 684 000 300 0 684 000 400 |
| Calibrated infrared exhaust-gas analyzer | e.g. ETT 008.04 or ETT 008.05 | 0 684 100 804 0 684 100 805 |
| Multimeter (internal resistance at least 20 k Ω /V) | | Commercially available, e.g. Metrawatt GmbH, Type MA2H or Fluke Multimeter 75 or 77 |
| Pressure gauge 6 bar or Pressure tester or Pressure tester (no longer available) | Quality class 1.0 0.1 bar graduations | 1 687 231 154 KDJE-P 100 KDEP 1034 |
| Three-way line as connection piece for KDJE-P 100 and KDEP 1034 | | KDJE-P 100/16 |



| <u>Description</u> | <u>Part No.</u> |
|---|--|
| Feeler gauge for measuring the sensor air gap (up to 1 mm) | Commercially available |
| Electrical connection cable (test lead) for direct connection of the components under test, e.g. resistor of the solenoid-operated injection valves | KDJE 7450/70 |
| Chassis dynamometer e.g. LPS 96 or LPS 002 | 0 680 017 001 0 680 100 200 |
| Test lead 2-pin, for measuring resistances and signals, e.g. at injection valves | 1 684 463 093 |
| Test leads for expert connection of testers to component plugs | KDZS 0004 (2.8 mm wide) KDZS 0005 (6.3 mm wide) |





7. Installation position of components (illustration: Sierra)

- 1 = Self-diagnosis connection
- 2 = Idle actuator
- 3 = Throttle-valve potentiometer
- 4 = Throttle cable

- 5 = Pressure regulator
- 6 = Air-flow sensor
- 7 = Ignition module (TFI IV)
- 8 = Ignition distributor

B1

Installation position of components
Ford



B2

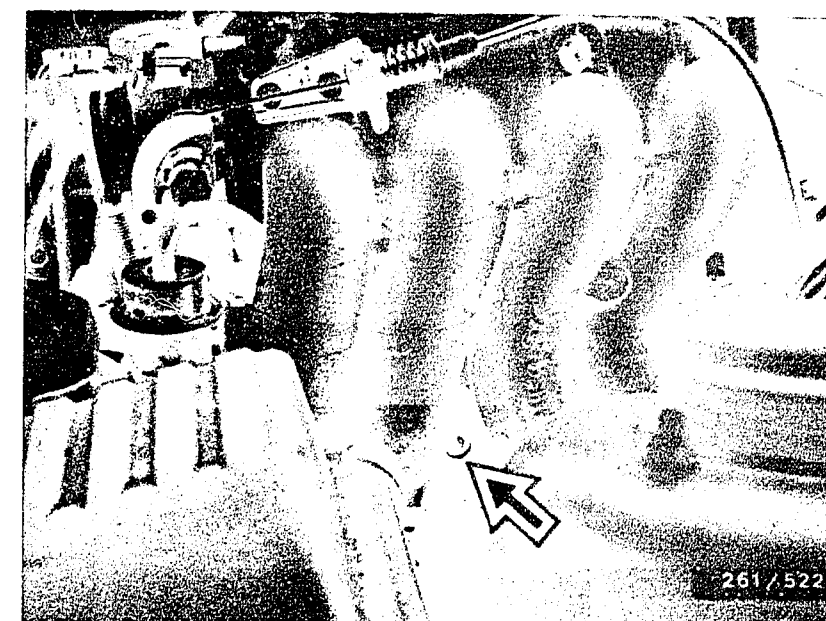
Installation position of components
Ford



Installation position of components (continued)

The indications "right" and "left" always refer to the forward direction of travel.

- EEC IV control unit:
In footwell on passenger's side, beneath the instrument panel (upper illustration)
- Engine temperature sensor:
Screwed into engine block below the intake manifold (lower illustration)
- Intake-air temperature sensor:
Integral in air-flow sensor
- Fuel filter:
Under the vehicle at left, near to fuel tank (Scorpio)
In engine compartment, at left at firewall (Sierra)
- Fuel pump:
Under the vehicle, near to fuel tank
- Ground terminal, control unit (term. 20):
On the body near the control unit (remove cover beneath instrument panel on passenger's side).
- Plug for octane/idle adjustment (red cap, if open)
Near ignition coil (center illustration - arrow, Sierra)
- Main relay, pump relay and pump fuse (Sierra):
Above the control unit (disconnect control unit withdrawing downwards and disconnect relay above the module from the metal holder).
The pump fuse and the pump relay are connected at the same plug.



B3

Installation position of components

Ford



B4

Installation position of components

Ford



- Main relay, pump relay and pump fuse (Scorpio)
Behind instrument panel (see upper illustration: 1 = Pump relay
2 = Main relay).

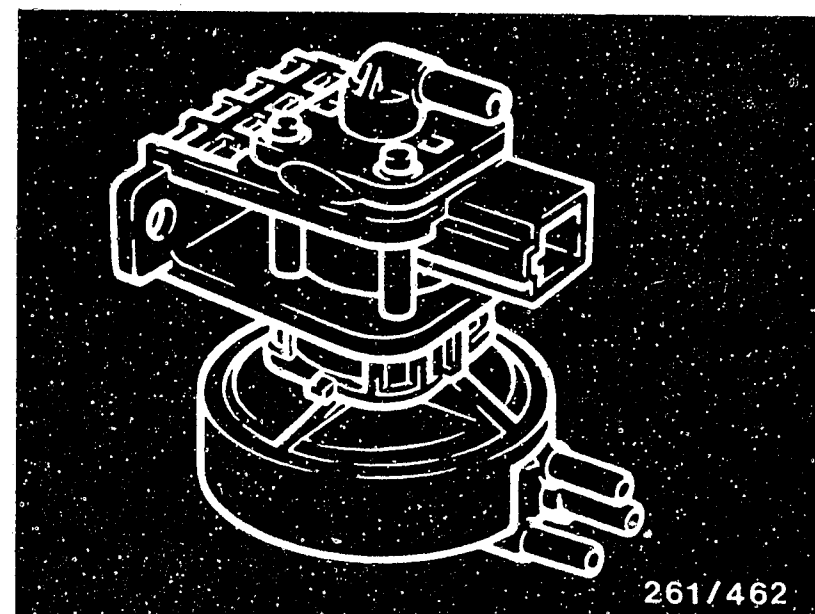
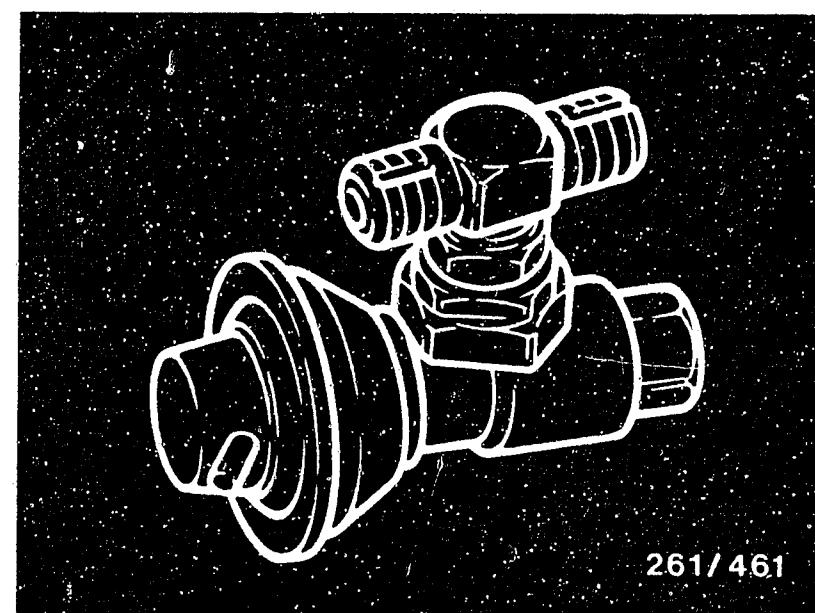
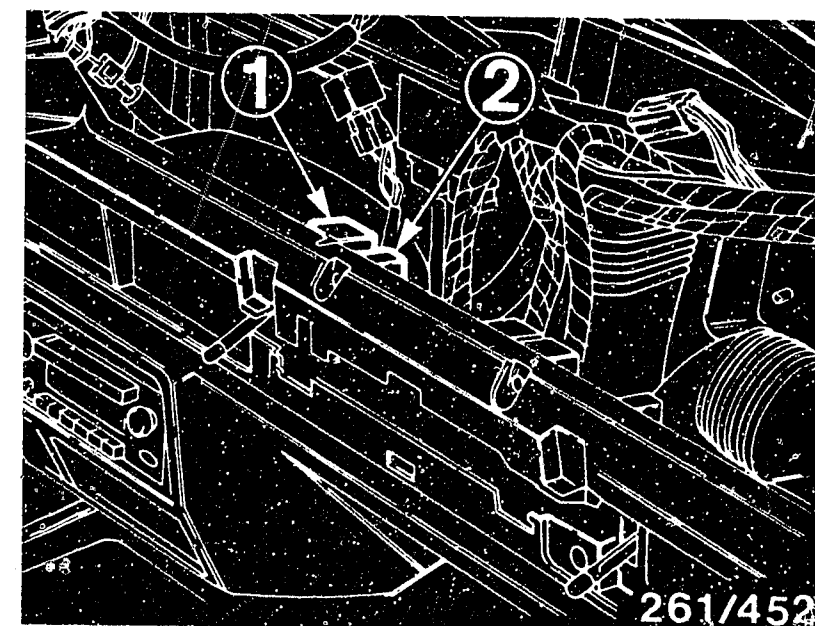
Note:

Remove instrument screen and upper safety covering (fastening screws and retaining clamps).

Pump fuse in glove compartment.

Additional in S/CH version:

- Exhaust-gas-recirculation valve (center illustration).
Beneath the intake-manifold pipes
- Vacuum converter (lower illustration):
In engine compartment, at right at firewall.



B5

Installation position of components

Ford



B6

Installation position of components

Ford



8. IMPORTANT GENERAL INFORMATION

This information must be observed in order to prevent damage to the engine, control unit or ignition coil and for the safety of personnel.

1. Never start engine without securely connected battery.
2. Incorrect polarity of the supply voltage, e.g. by incorrect connection of the battery or ignition coil, can lead to irreparable damage to the control unit.
3. Do not use a fast charger for starting the engine.

Use only a second 12 V battery and jump leads.

Caution! Owing to different requirements of vehicle manufacturers with regard to electronic products we advise you not to use 24 V batteries as an aid for starting. Follow the vehicle owners manual.

4. Disconnect the battery from the vehicle electrical system before fast charging.
5. When charging the battery in the vehicle or when using a starting aid, follow the information in the operating instructions of the fast charger and also follow the information given by the vehicle manufacturer.
6. Never disconnect the battery from the vehicle electrical system with the engine running.
7. Do not short-circuit ignition coil term. 1 to ground (e.g. for stopping the engine). The ignition coil and possibly the control unit will suffer irreparable damage.
8. Never bring the positive pole of the battery into contact with ignition coil term. 1. The control unit will suffer irreparable damage.



9. Never connect or disconnect the wiring-harness plug of the control unit with the ignition switched on.
10. Remove the control unit at temperatures above 80°C (paint-drying installation).
11. Remove the control unit before performing welding work (electric spot welding).
12. Remove the relay combination when performing a compression test. This prevents undesired injecting of the injection valves.
13. When installing an alarm system observe the information in the installation instructions for Motronic vehicles or the SIS microcard ALL-500.


It must be ensured that the alarm relay does not suffer interference from stray fields (e.g. from H.T. ignition cables), causing it to trip incorrectly.

14.

CAUTION!

High-energy ignition system.

Dangerous primary and secondary voltages.



Contact with voltage-carrying parts or terminals can be extremely hazardous or fatal (on the primary as well as secondary side).



9. Trouble-shooting following customer complaints

Interrogation of the self-diagnosis unit must come at the start of trouble-shooting, thus making trouble-shooting easier.

The table below contains different symptoms of trouble with several possible causes of trouble in each case. The right-hand column gives the first coordinate for the test sequence of the respective individual components of the system. If, after completing testing of the individual components, the fault has not been located or remedied, it is necessary to choose a new fault symptom.

Customer complaints (symptoms of trouble)

1. Engine fails to start or starts only with great difficulty
2. Engine starts but then dies
3. Uneven engine idle and/or incorrect idle speed
4. Poor throttle response
5. Misfiring
6. Fuel consumption too high
7. No maximum engine power and/or top speed
8. CO concentration at idle too high or too low

| Cause (component fault) | | | | | | | | Coordinate |
|-------------------------|---|---|---|---|---|---|---|--|
| • | • | • | • | • | • | • | • | Interrogate self-diagnosis C 5, C 12 |
| • | | | | | | | | Main relay or pump relay defective C 8, C 16 |
| • | | | | | | • | | Electric fuel pump defective C 8, D 9 |
| • | • | • | • | | | | | Low-idle-speed control defective D 13, E 15 |
| | | • | | | | • | | Throttle-valve potentiometer defective D 13 |
| • | • | • | • | • | • | • | • | Air-flow sensor defective D 15, D 18 |
| | | • | | | | | | Exhaust-gas recirculation defective (S/CH version) E 17 |

Customer complaints (symptoms of trouble)

1. Engine fails to start or starts only with great difficulty
2. Engine starts but then dies
3. Uneven engine idle and/or incorrect idle speed
4. Poor throttle response
5. Misfiring
6. Fuel consumption too high
7. No maximum engine power and/or top speed
8. CO concentration at idle too high or too low

| | | | | | | | | Cause (component fault) | Coordinate |
|---|---|---|---|---|---|---|---|---|------------|
| • | • | • | • | | | • | • | Air-intake system leaking | E 11 |
| • | | • | • | | • | • | | Solenoid-operated injection valves defective | C 14, C 18 |
| • | | • | | | | • | • | Fuel pressure too low or zero; pressure regulator not operating | D 1 |
| | | • | | | • | | • | Fuel pressure too high; pressure regulator not operating | D 1 |
| | | | | • | | • | | Fuel delivery too low | D 9 |
| | | • | | | | | | Throttle-valve basic setting incorrect | D 11 |
| | | | | | | • | | Throttle-valve not opening fully | D 11 |
| • | • | • | | • | | | | Poor central ground, loose contacts, faulty plug connections | C 16, C 18 |
| | • | • | • | • | • | • | • | Control unit in emergency program (LOS) | C 10 |
| • | | • | • | • | • | • | • | Check ignition point | E 9 |
| • | | • | | • | | | | "Hall generator" and/or ignition module defective | E 3, E 5 |
| | | • | | | • | | • | CO exhaust-gas setting too rich | E 15 |
| | | • | • | | | | • | CO exhaust-gas setting too lean | E 15 |
| • | • | | | | • | | • | Intake-air or engine-temperature sensor defective | D 21, D 23 |

C3

Trouble-shooting

Ford



C4

Trouble-shooting

Ford



10. Self-diagnosis

The results of self-diagnosis may be requested at the test plug (upper illustration) in the form of a flashing code (on/off pulses) with the engine running. A test lamp (LED indicator) or an analog voltmeter (measuring range 15 V) can be connected at socket 1 of the test plug (+ terminal to battery +). In addition, sockets 4 and 5 of the test plug must be short circuited (center illustration).

Note: If the engine does not start, turn over starting motor for 5 s. Then leave ignition switched on and follow indication.

The coded information is given as follows:

- Start of test – ON pulse of 5 s duration (pointer deflects or LED lights up).
- After 4 s break, the codes (there may be several, if several faults in system simultaneously) are given one after the other.
- Each code consists of 2 figures (4 s break between).
- Each figure is represented by a series of pulses of 1 s duration.
- The test cycle is repeated for as long as sockets 4 and 5 are connected to each other and the engine is running.

Example: Code 12 = defective air-flow sensor or instrument lead (lower illustration):

a = Starting pulse (5 s)

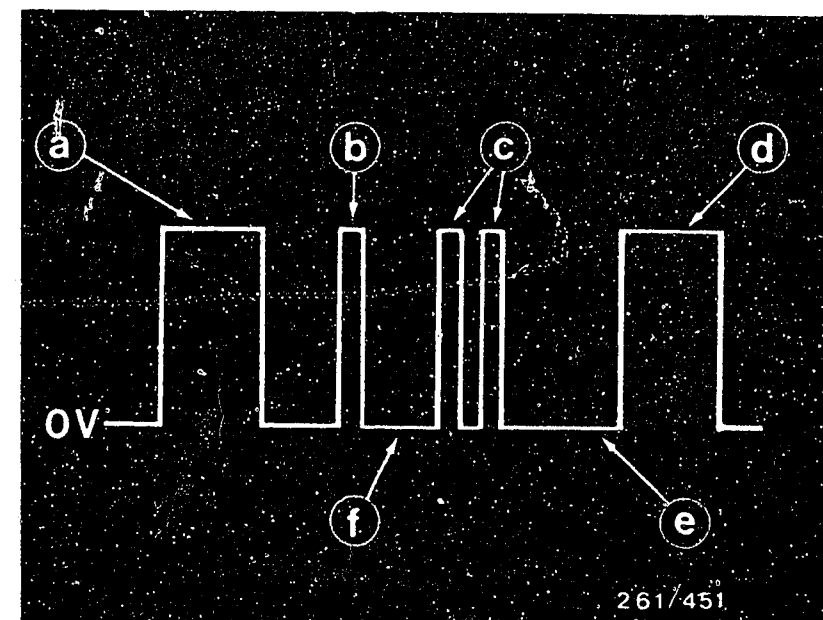
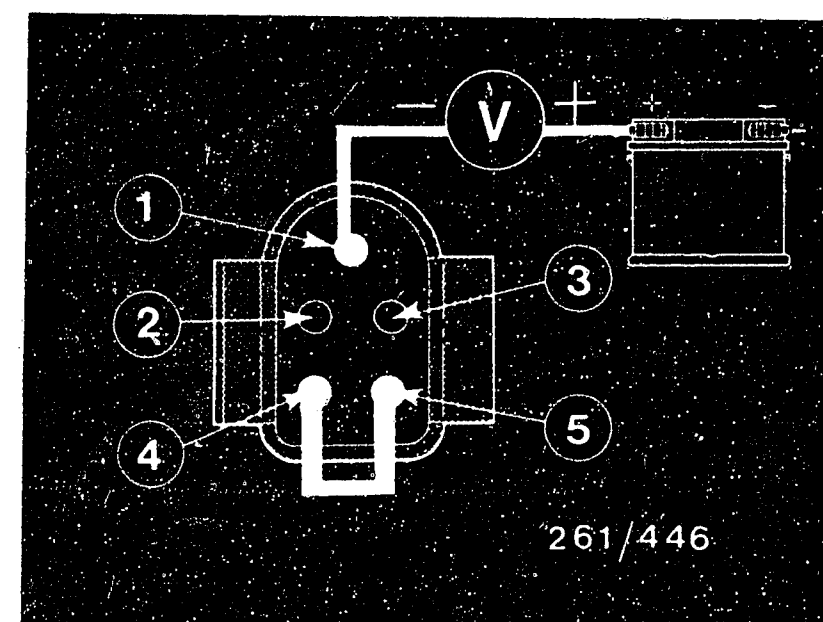
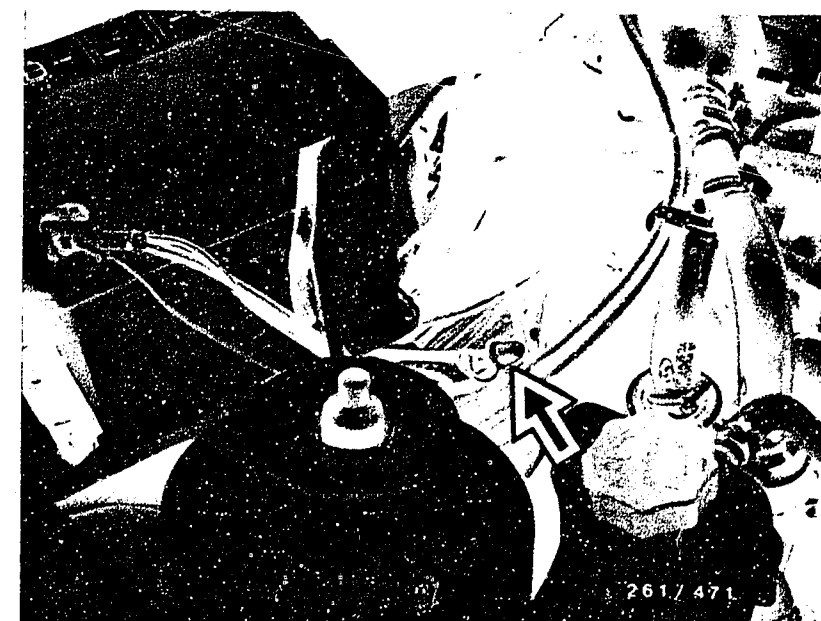
b = First figure of code (1 pulse of 1 s duration)

c = Second figure of code (2 pulses each of 1 s duration)

d = Start of second code (5 s)

e = End of first code (6 s break)

f = Interval between figures (4 s break)



C5

Self-diagnosis
Ford



C6

Self-diagnosis
Ford



Flashing code table

| Code | Trouble-shooting | Connection at control unit |
|------|---|-----------------------------------|
| 11 | No fault found | - |
| 12 | Air-flow sensor or instrument lead | Term. 26/46/43 Term. 26/46/27* |
| 13 | Engine temperature sensor or instrument lead | Term. 46/7 |
| 14 | Air temperature sensor or instrument lead | Term. 46/25 |
| 15 | Throttle-valve potentiometer or instrument lead | Term. 26/46/47 |
| 31 | Fault in control unit | - |
| 32 | Fault in control unit | - |

* S/CH version

Note:

If the control unit does not transmit a flashing code, switch off ignition, turn ignition key to position II and wait for 5 s. Restart engine. Flashing code must appear.



11. Component testing

Is fuel pump running?
(Check by listening).
Switch on ignition and listen
for running noise of pump
(approx. 1 s).

no

1. Check pump fuse (No. 30).
2. Disconnect pump relay and short circuit in plug-in base term. 30 and 87: if pump not running, check positive and ground cables to pump. Check connections for corrosion, otherwise fuel pump defective.

If fuel pump runs, continue test from 3.
3. Switch off ignition.
Unscrew control-unit plug and connect in plug term. 20 and 22.
Switch on ignition.
Fuel pump running, fault in control unit, replace.
Fuel pump not running, check lead from control unit term. 22 to pump relay term. 85.
If lead not O.K., relay defective, replace.

yes

Continued on next micropicture

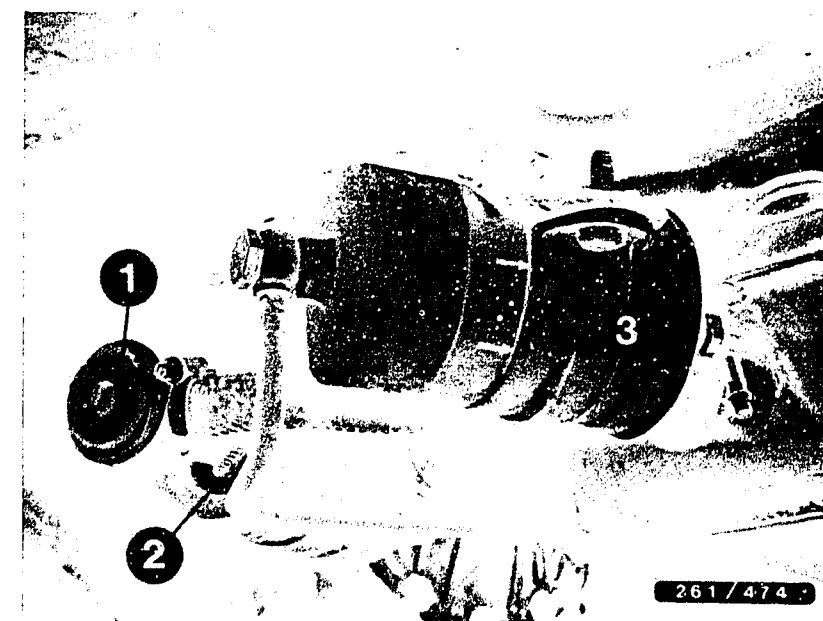


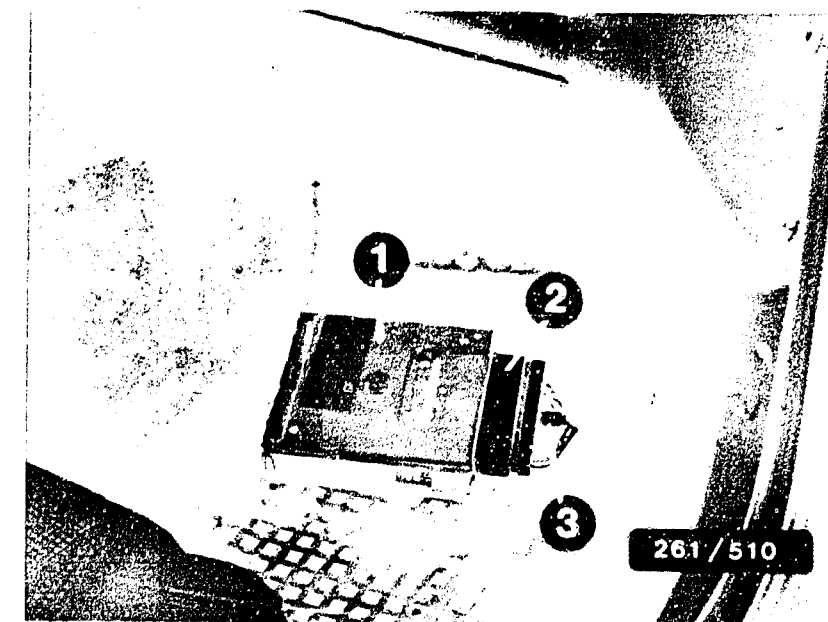
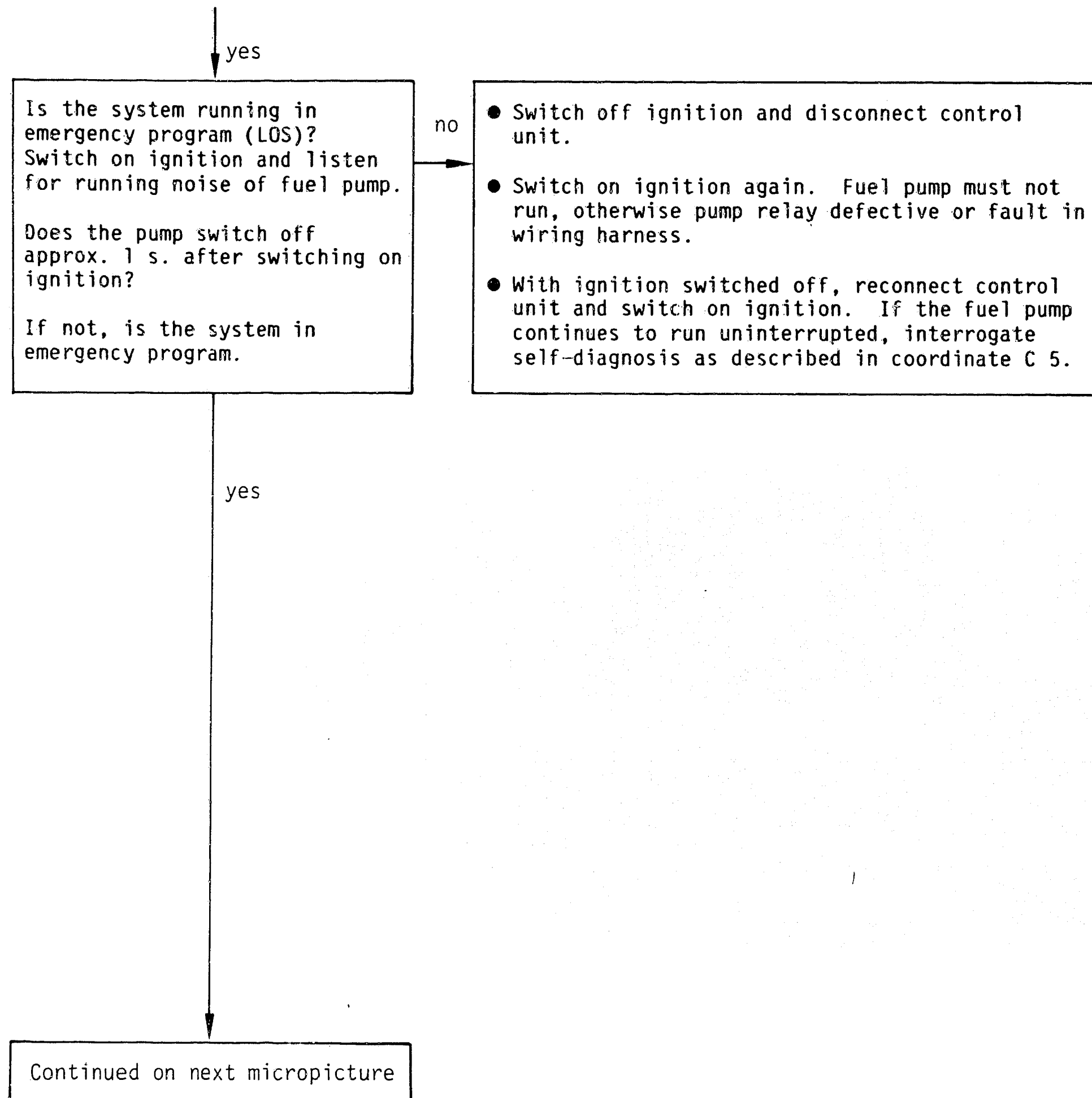
Illustration: Scorpio

1 = Fuel-line-pressure damper

2 = Fuel pump

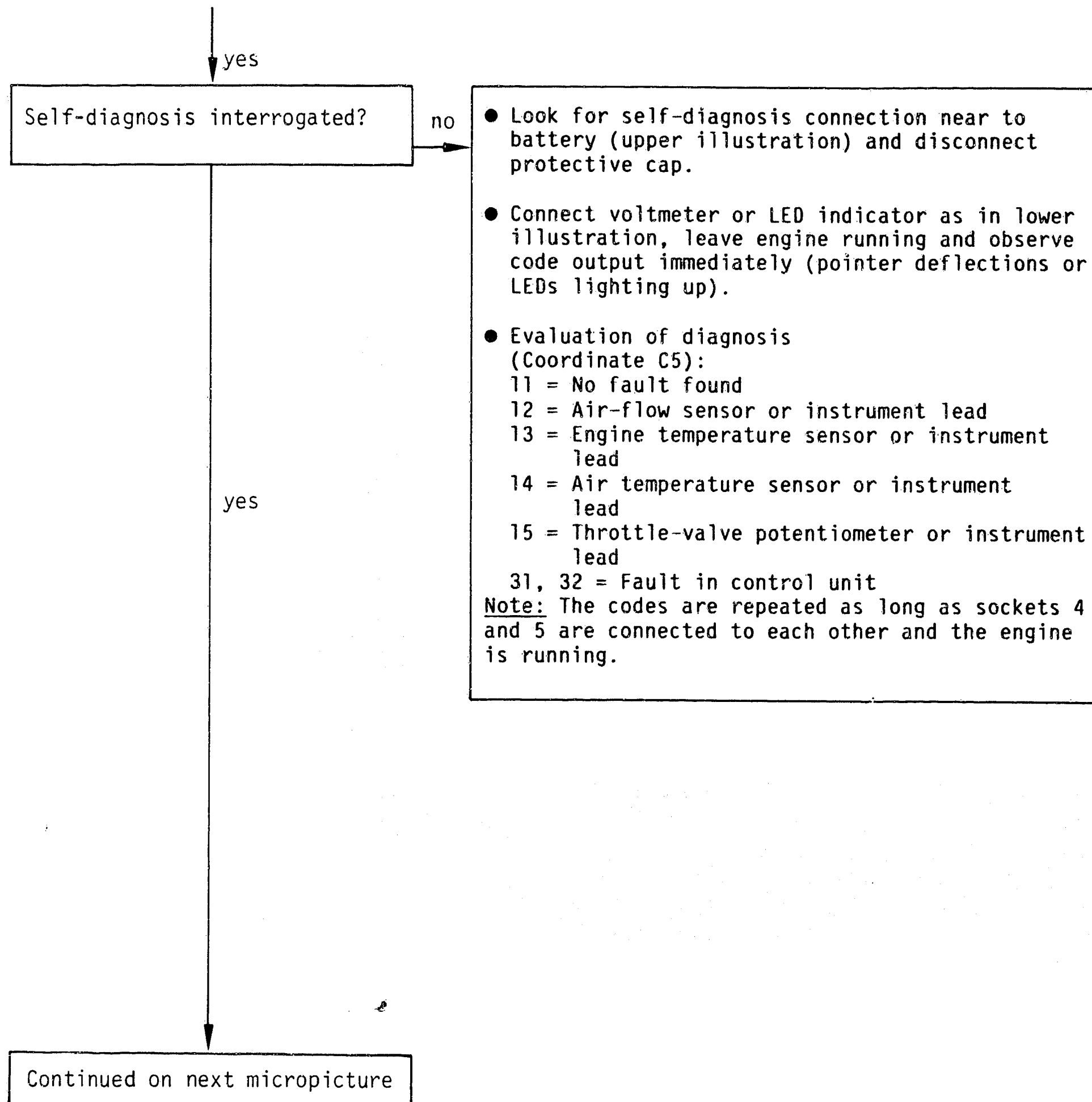
3 = Fuel filter (in Sierra, in engine compartment)





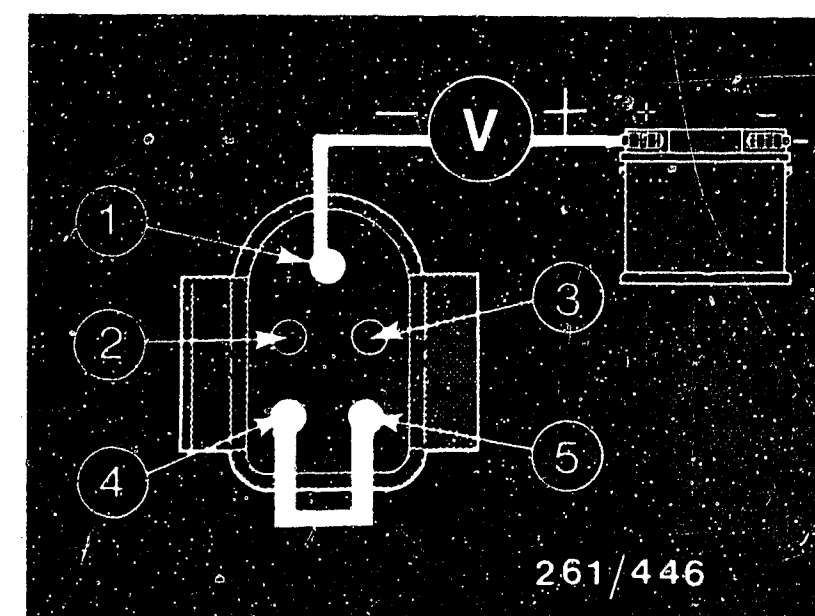
- 1 = EEC IV control unit
2 = Control-unit plug
3 = Fastening screw
for control-unit plug

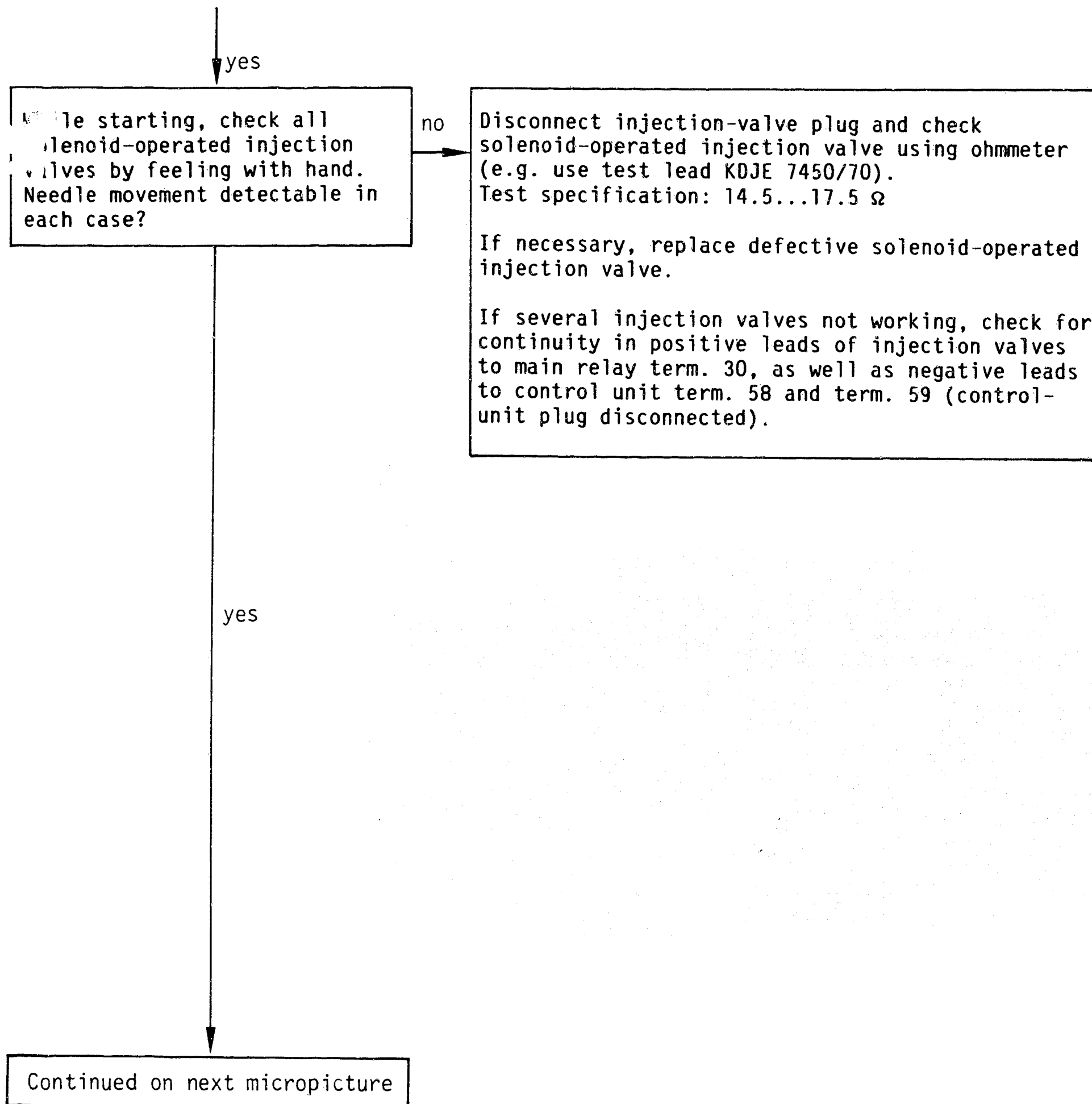




Arrow = Self-diagnosis connection (test plug)

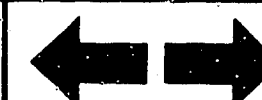
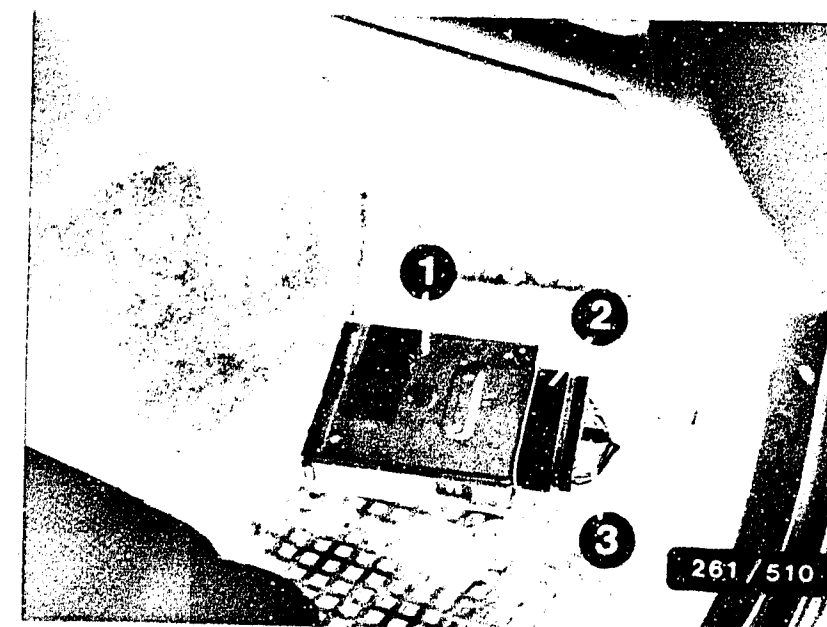
Illustration: Connection of voltmeter at test plug for interrogation of self-diagnosis





Arrow = Injection-valve plug (4)

- 1 = EEC IV control unit
- 2 = Control-unit plug (60-pin)
- 3 = Fastening screw for control-unit plug



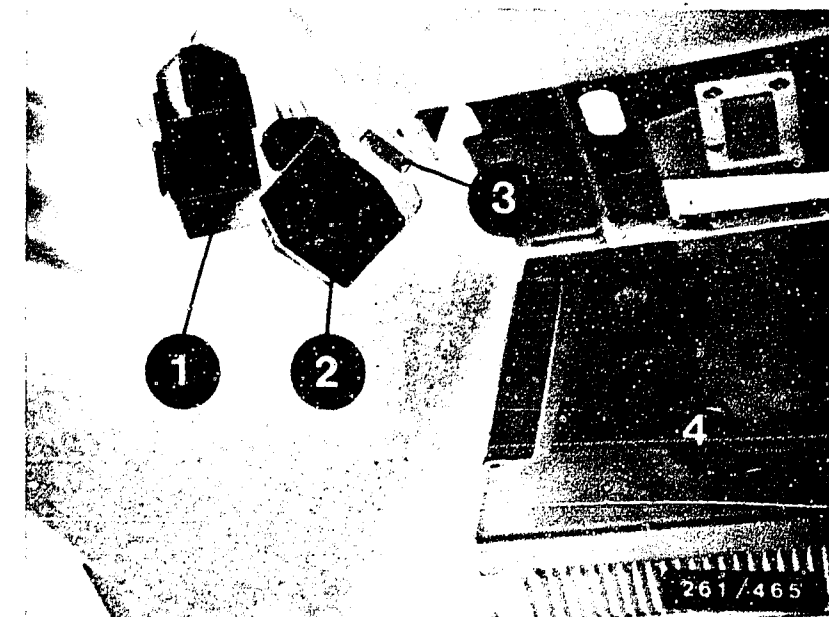
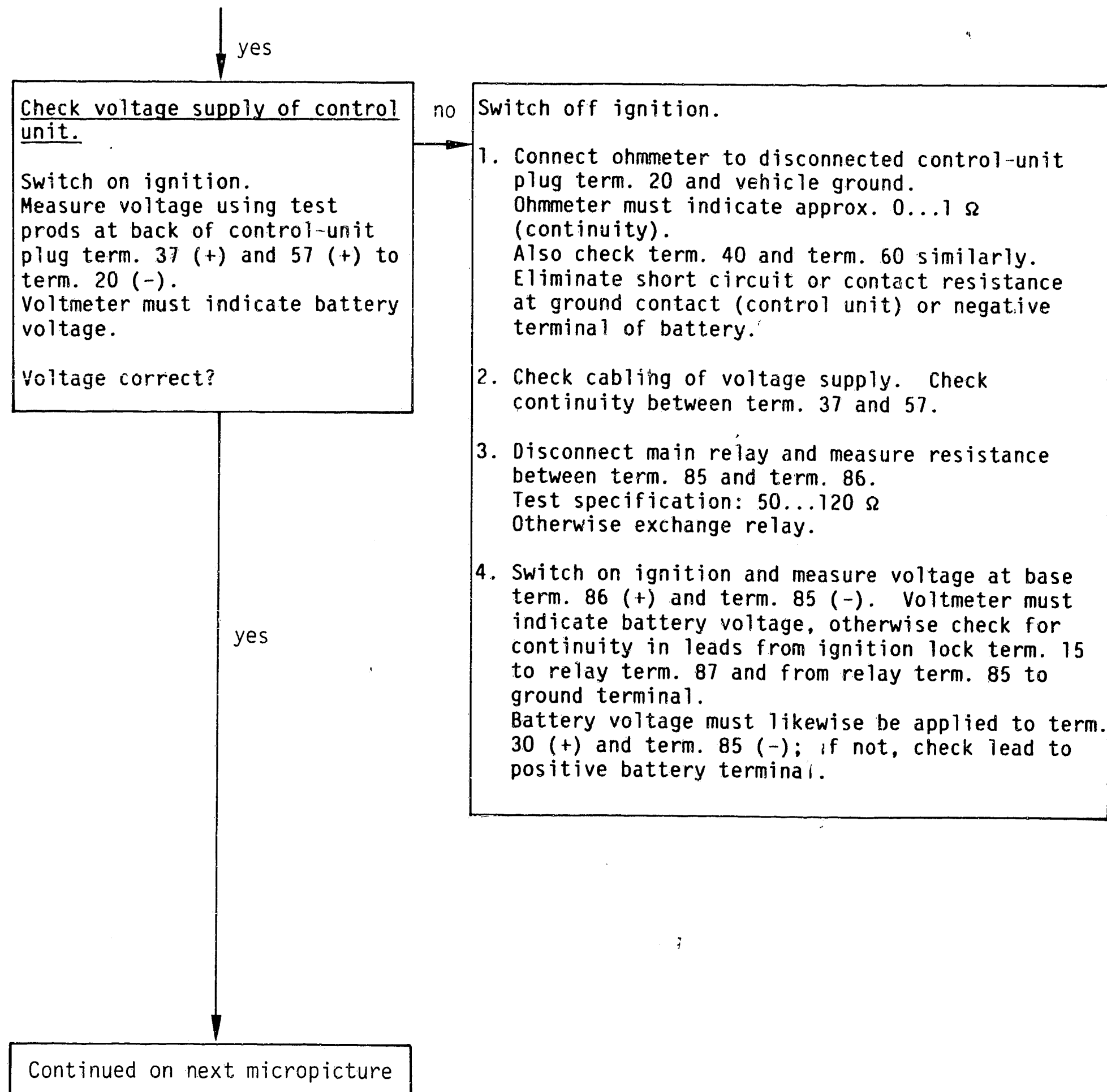
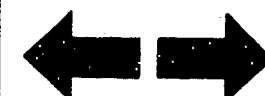
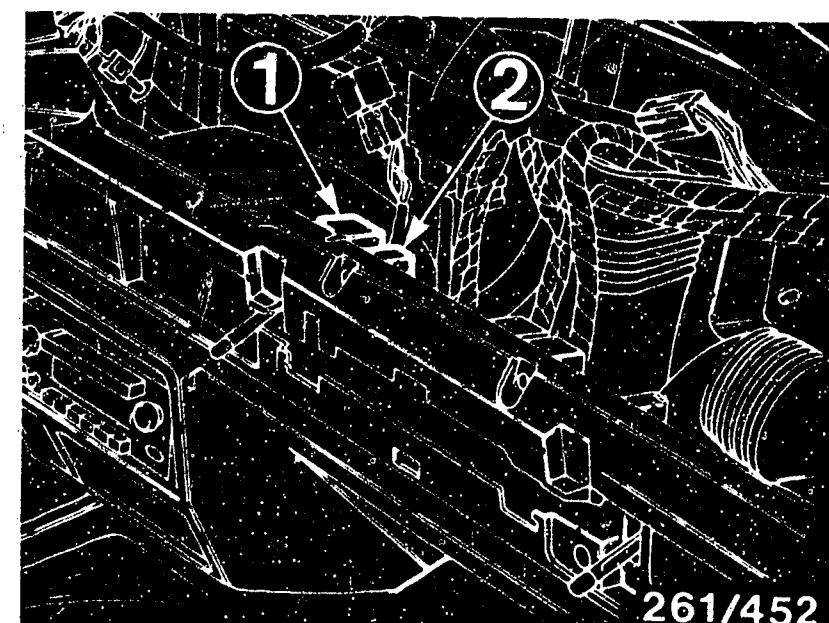


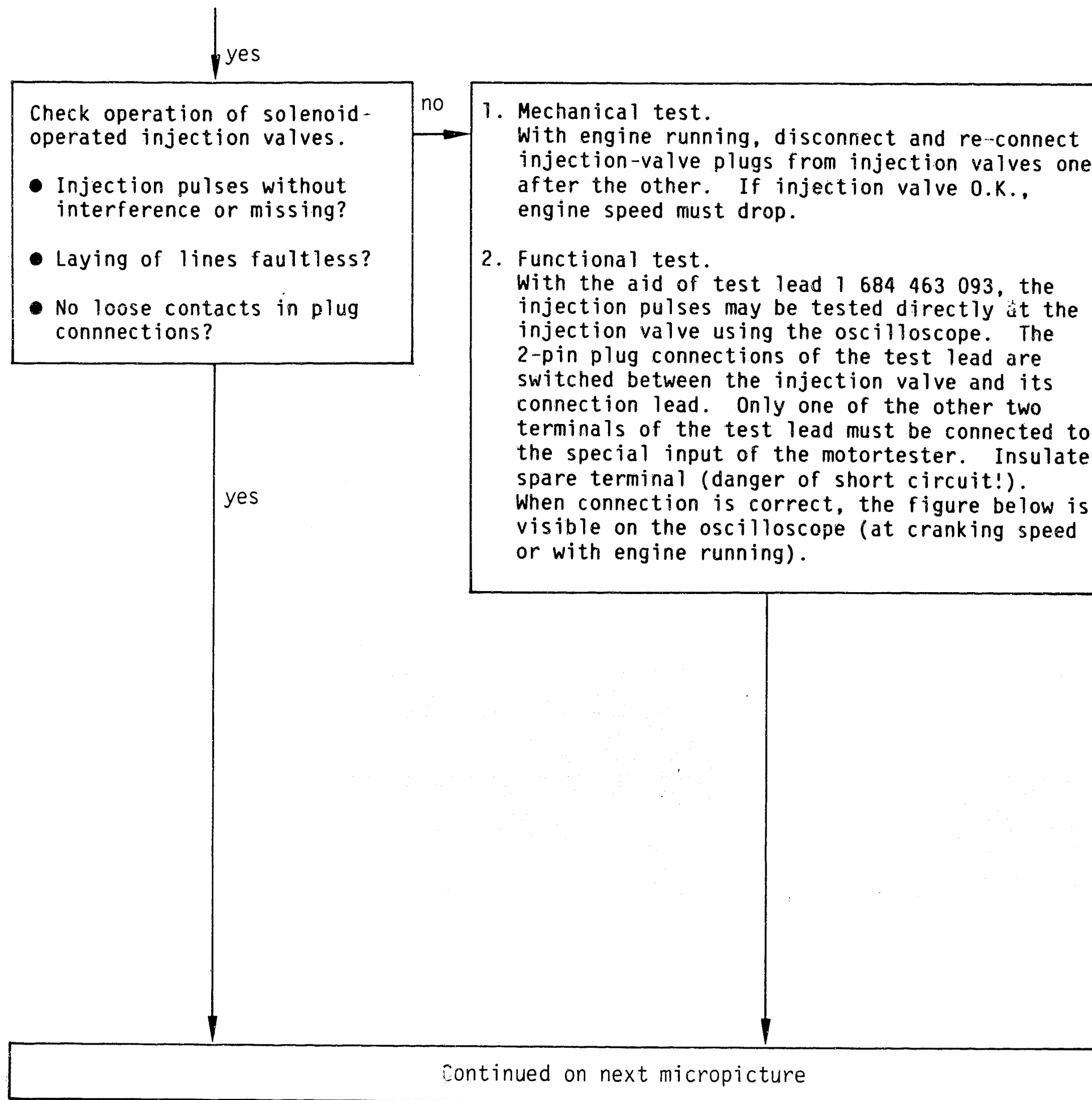
Illustration = Installation position of main relay and pump relay in Sierra

| | |
|---|-----------------------|
| 1 | = Main relay |
| 2 | = Pump relay |
| 3 | = Pump fuse |
| 4 | = EEC IV control unit |

Illustration = Installation position of main relay and pump relay in Scorpio

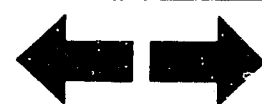
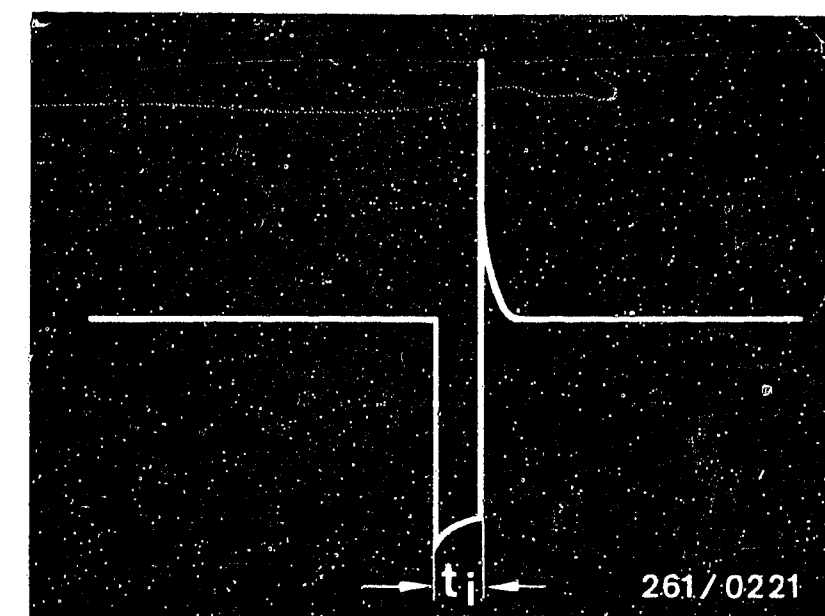
| | |
|---|--------------|
| 1 | = Pump relay |
| 2 | = Main relay |





Arrows = Injection-valve plug (4)

Injection signal
 t_i = Duration of injection



3. Removal of solenoid-operated injection valves
Loosen fastening screws at fuel-distribution pipe. Pull fuel-distribution pipe upwards until solenoid-operated injection valves are out of the bore in the intake manifold. Do not damage nozzle needle and rubber seal.

Check nozzle needle and surroundings for leaks and deposits.

Disconnect electrical connection.

Carefully push retaining clamp out of groove and pull solenoid-operated injection valve out of fuel-distribution pipe connection.

Caution!

Catch escaping fuel. Do not allow to drip onto hot engine components. Fire hazard!

Caution!

Protective sleeve must not be levered off.

Installation of solenoid-operated injection valves

Exchange damaged or expanded O-rings.

Use parts set 1 287 010 704.

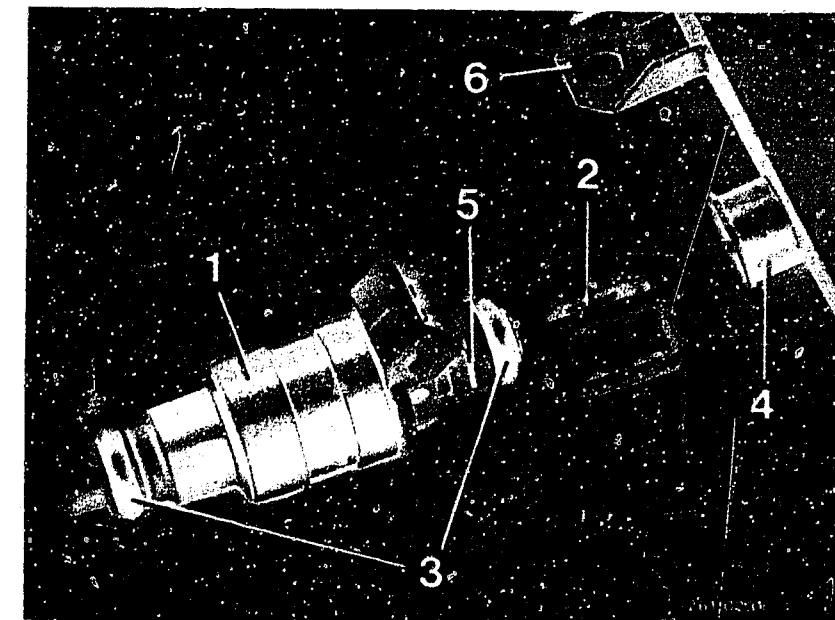
Cut up lower O-ring (intake manifold).

Caution! Do not damage protective sleeve.

Pull new O-ring over protective sleeve and its shoulder. Do not damage any parts when doing so.

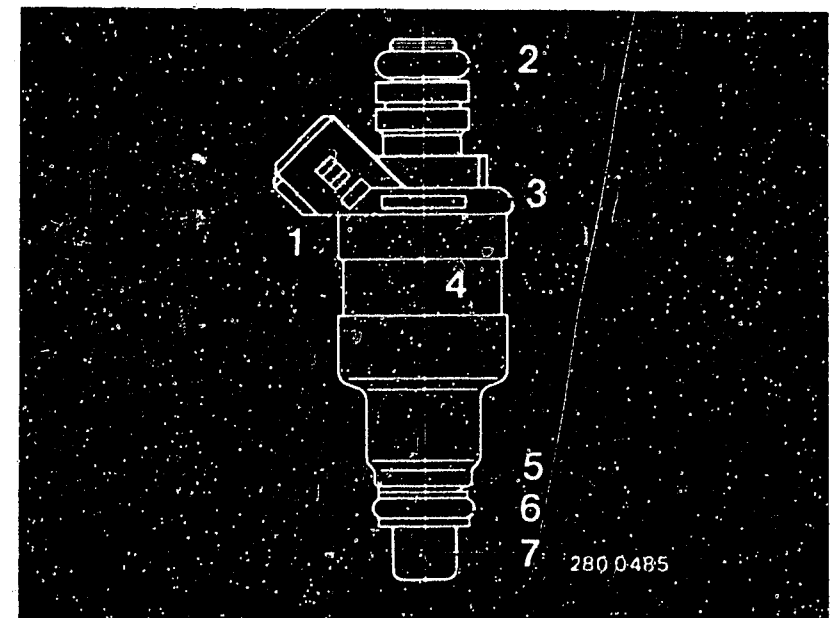
yes

Continued on next micropicture



- 1 = Solenoid-operated injection valve
- 2 = Retaining clamp
- 3 = Rubber seal
- 4 = Fuel-distribution pipe connection
- 5 = Groove
- 6 = Fastening bracket

- 2 = Upper O-ring
- 6 = Lower O-ring
- 7 = Protective sleeve



C20

Component testing
Ford



C21

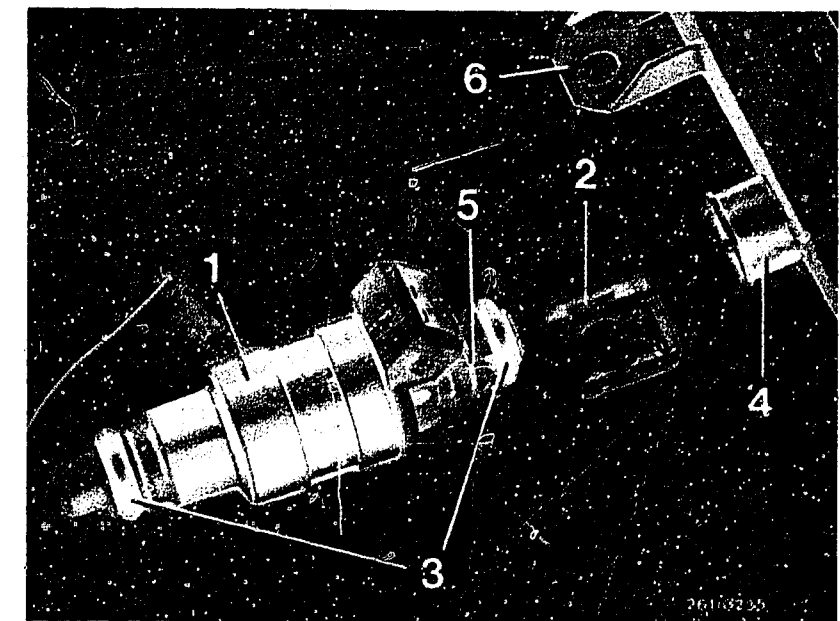
Component testing
Ford



Before installation, check both rubber seals for perfect seating. Secure solenoid-operated injection valves at fuel-distribution pipe. Push all solenoid-operated injection valves simultaneously with the fuel-distribution pipe into the seats. Tighten fuel-distribution pipe. Check all air and fuel hoses for perfect seating. Make electrical connections.

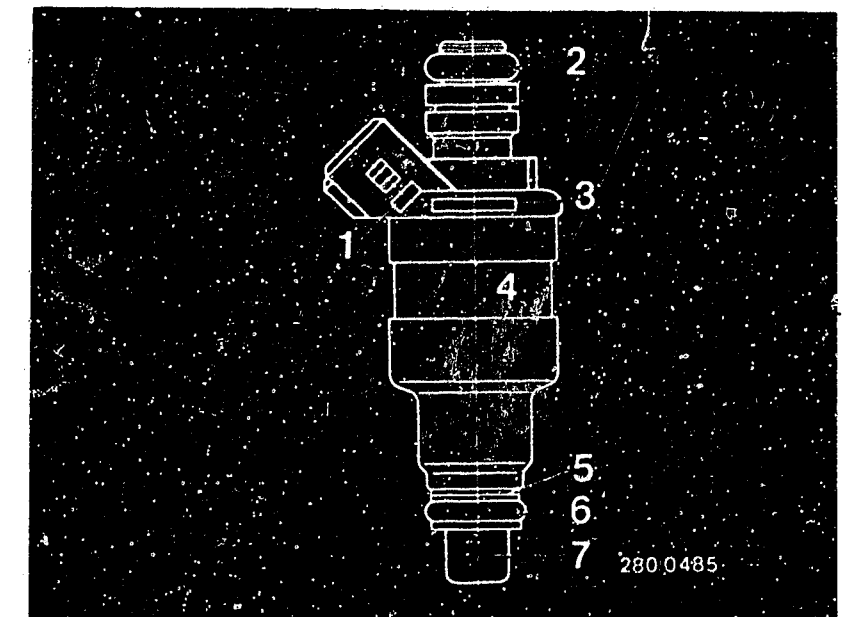
Start engine and check whether any unmetered air is inducted.

yes



- 1 = Solenoid-operated injection valve
- 2 = Retaining clamp
- 3 = Rubber seal (O-ring)
- 4 = Fuel-distribution pipe connection
- 5 = Groove
- 6 = Fastening bracket

- 2 = Upper O-ring
- 6 = Lower O-ring
- 7 = Protective sleeve



Continued on next micropicture

C22

Component testing
Ford



C23

Component testing
Ford



Fuel pressure correct?
Test specification: 2.3...2.7 bar
Test specification obtained?

no

Testing fuel pressure
Connect fuel-pressure pressure gauge. To do this, unscrew fuel-pressure line and fuel-distribution pipe (see upper illustration) and insert connection piece KDJE-P 100/16.

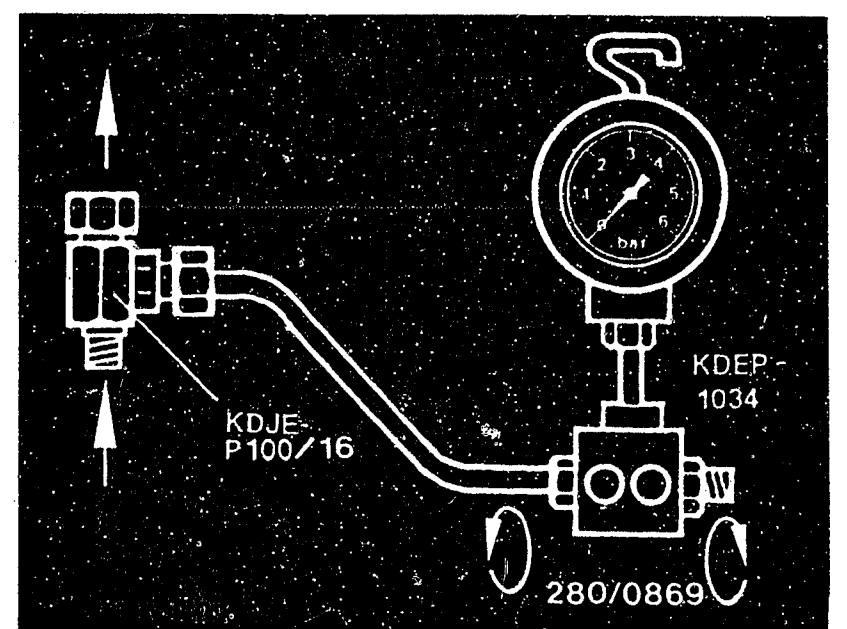
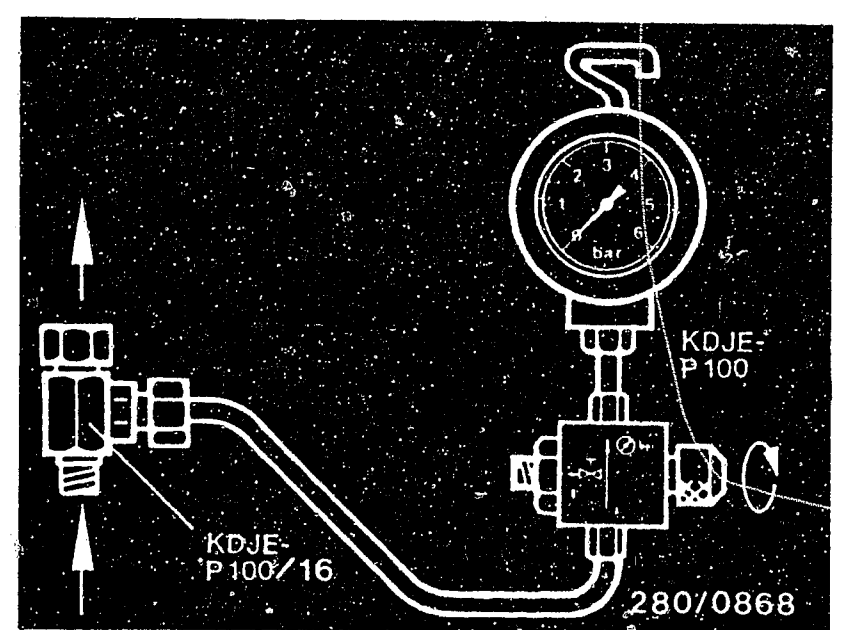
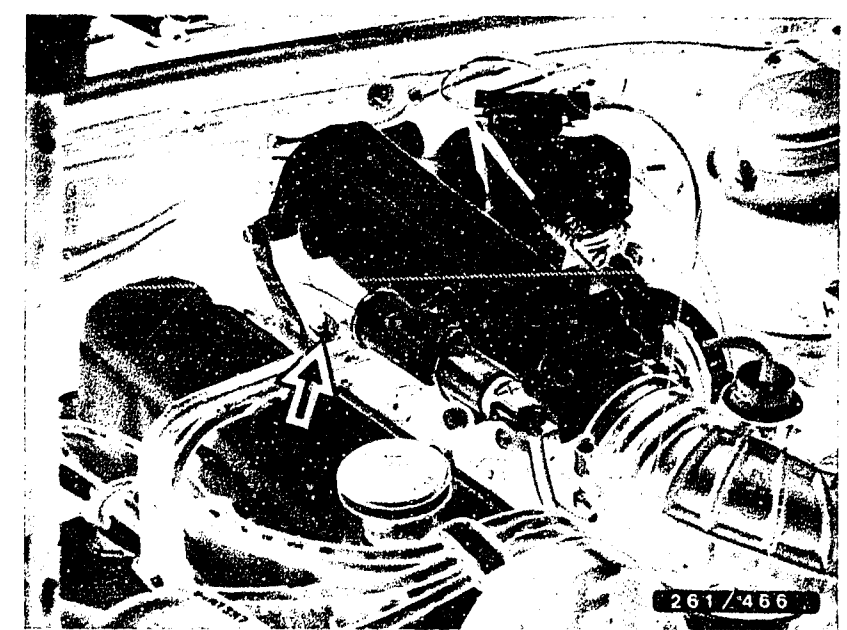
Caution! When loosening the fitting, make sure that fuel does not make contact with hot engine components.

When using the pressure gauge KDJE-100, the valve screw must be screwed shut; with KDEP-1034, only the right-hand one.

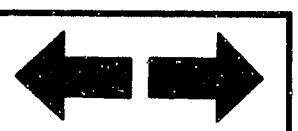
Make certain there are no leaks at connections.

Continued on next micropicture

yes



Continued on next micropicture



Disconnect control-unit plug (with ignition switched off), short circuit term. 20 and term. 22 in plug and switch on ignition. Fuel pump must run.

Fuel-pump pressure:

2.3...2.7 bar

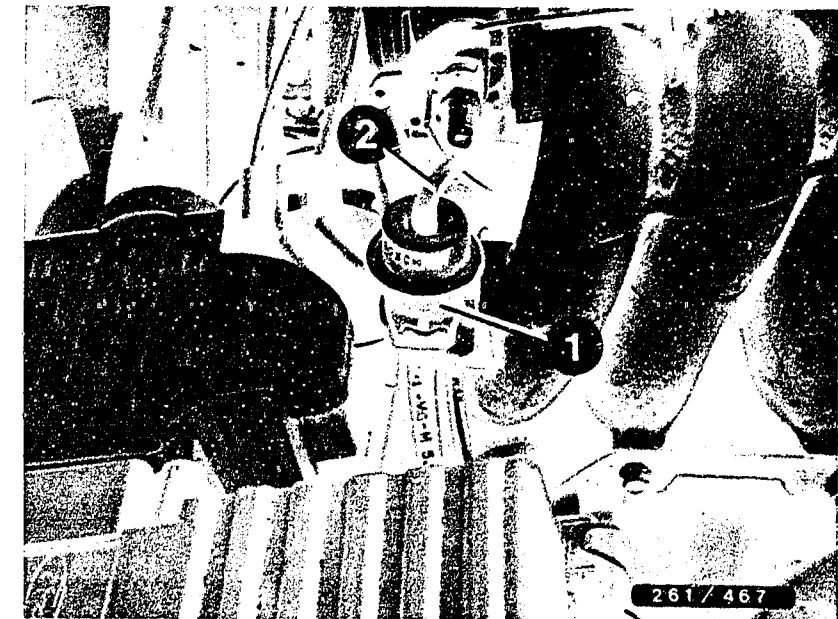
Afterwards, leave engine running at idle. Pressure gauge must indicate

approx. 2.0 bar;

otherwise check air hose to pressure regulator for leaks, if necessary, replace pressure regulator.

yes

Continued on next micropicture



1 = Fuel-pressure regulator
2 = Air hose to intake manifold

D3

Component testing
Ford



D4

Component testing
Ford



When faults:

Fuel pressure falls below 2.3 bar:

1. Slowly squeeze fuel return line. (Caution! Do not load pressure gauge above 6 bar).

Pressure rises to above 4 bar - replace pressure regulator.

Pressure remains below 4 bar - replace fuel pump.

2. Check fuel-pressure line and filter for continuity.

3. Tank vent blocked?

Remove tank cap, repeat measurement.

4. Strainer in tank blocked.

5. Corrosion in tank.

Fuel pressure exceeds 2.7 bar:

1. Fuel return line blocked or pinched.

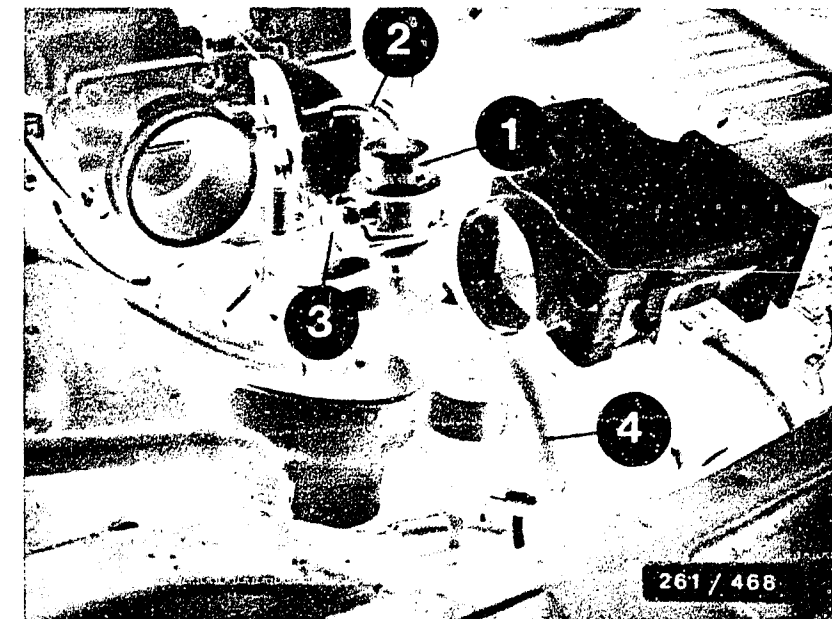
2. Replace pressure regulator.

Attention!

After completing test, remove bridge between term. 20 and 22 in plug and reconnect control unit.

yes

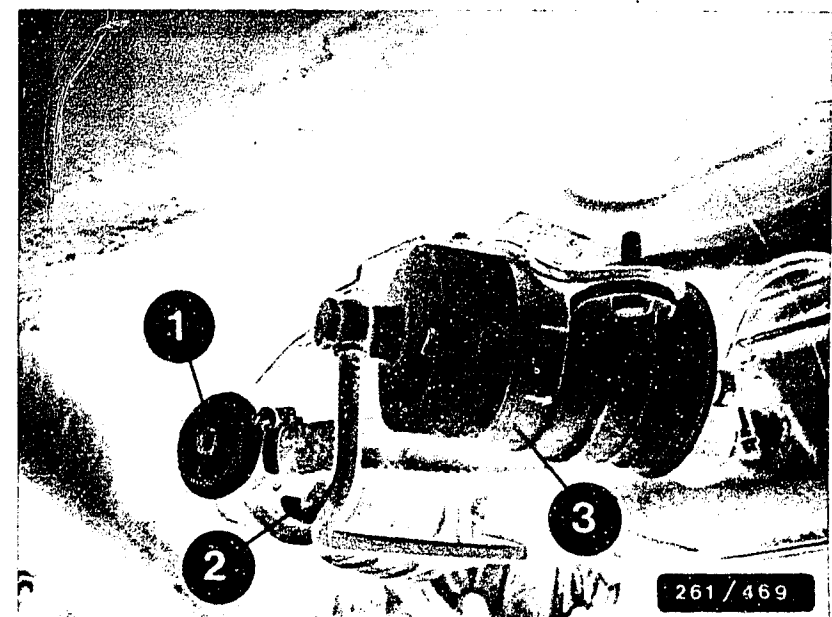
Continued on next micropicture



- 1 = Fuel-pressure regulator
2 = Air hose to intake manifold
3 = Connection to fuel-distribution pipe (primary pressure)
4 = Fuel return hose

Illustration: Scorpio

- 1 = Fuel-line-pressure damper
2 = Fuel pump
3 = Fuel filter (in Sierra, in engine compartment)



D5

Component testing

Ford



D6

Component testing

Ford



Fuel pressure remains almost constant after switching off engine?

no

Fuel pressure drops quickly after switching off hot engine.

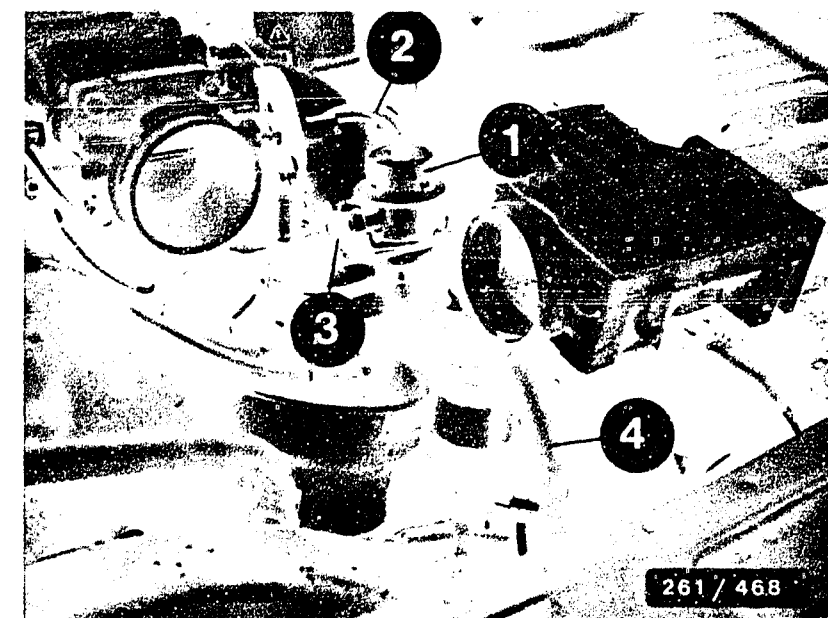
- Check fuel system for leaks:
After switching off engine, fuel pressure must drop only very slowly (after approx. 20 mins, fuel pressure still at least 1.0 bar).

When faults:

- Check for leaks at connection points between components and fuel hoses and lines.
- Pressure regulator (diaphragm)
- Solenoid-operated injection valves (needle seat, valve does not close properly).
- Electric fuel pump (leaking non-return valve)
- Fuel filter leaking.

yes

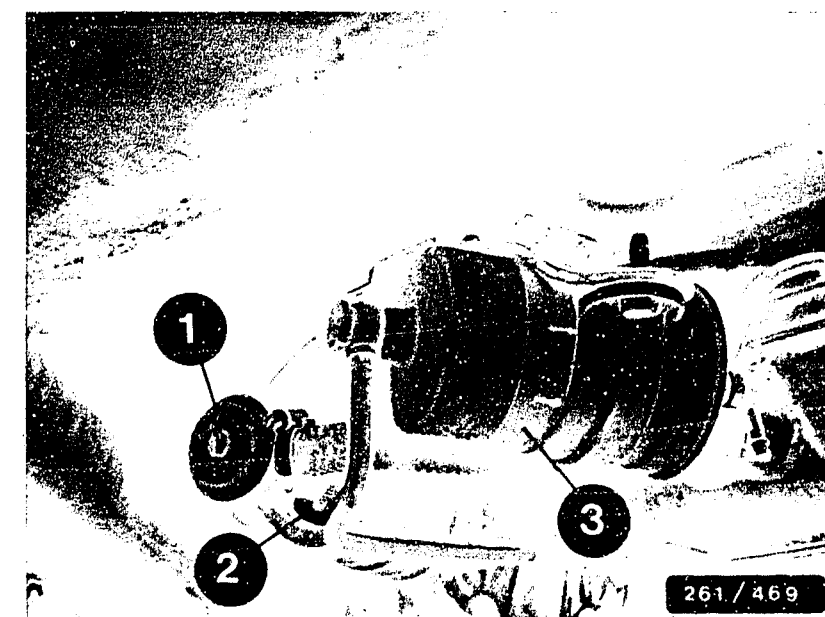
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- 1 = Fuel-pressure regulator
- 2 = Air hose to intake manifold
- 3 = Connection to fuel-distribution pipe (primary pressure)
- 4 = Fuel return hose

Illustration: Scorpio

- 1 = Fuel-line-pressure damper
- 2 = Fuel pump
- 3 = Fuel filter (in Sierra, in engine compartment)



D7

Component testing
Ford



D8

Component testing
Ford



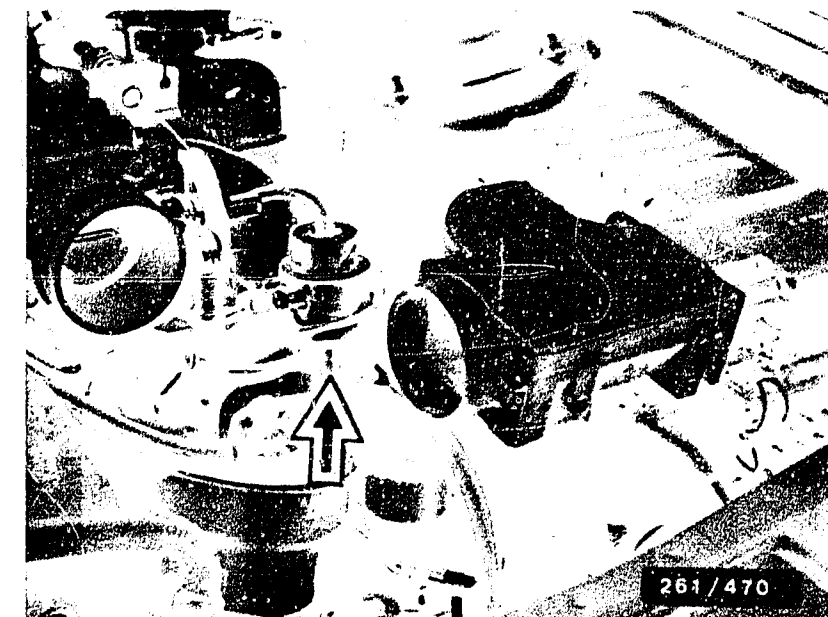
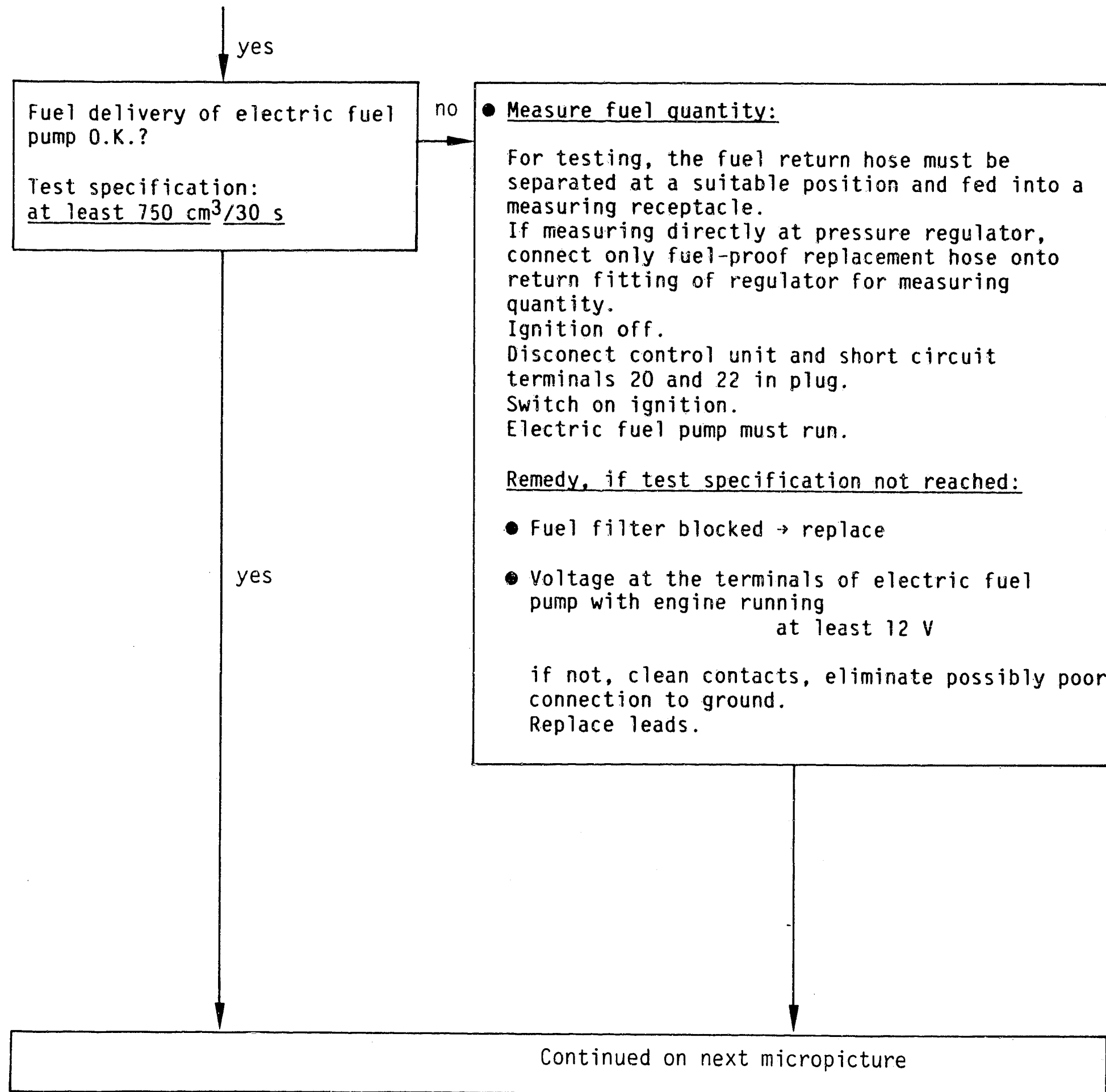
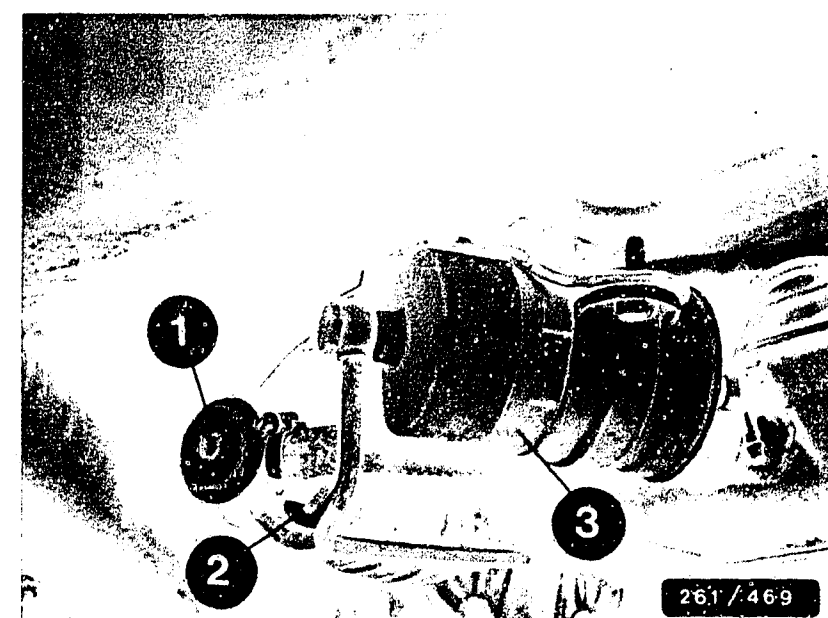


Illustration: Scorpio
1 = Fuel-line-pressure damper
2 = Fuel pump
3 = Fuel filter (in Sierra, in engine compartment)

Arrow = Hose clamp of fuel return hose at pressure regulator



D9

Component testing
Ford

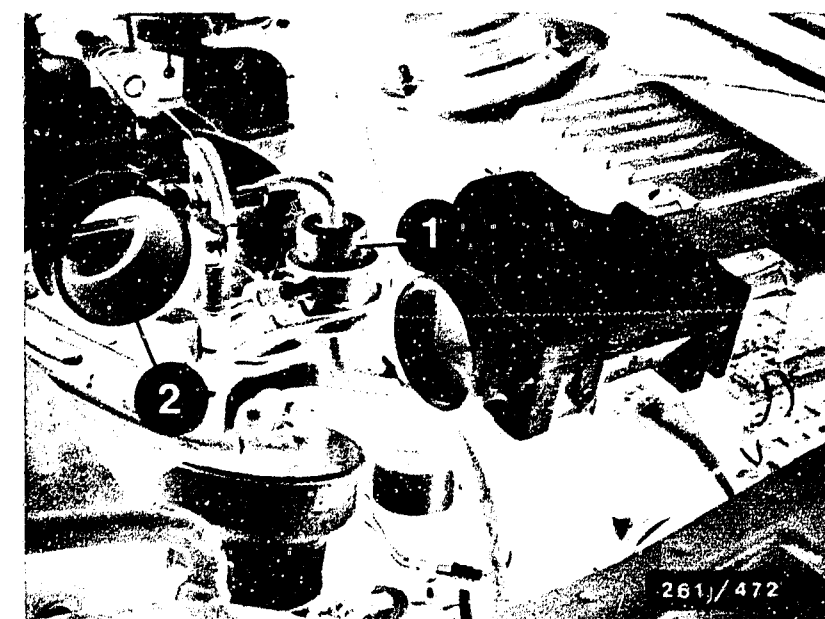


D10

Component testing
Ford

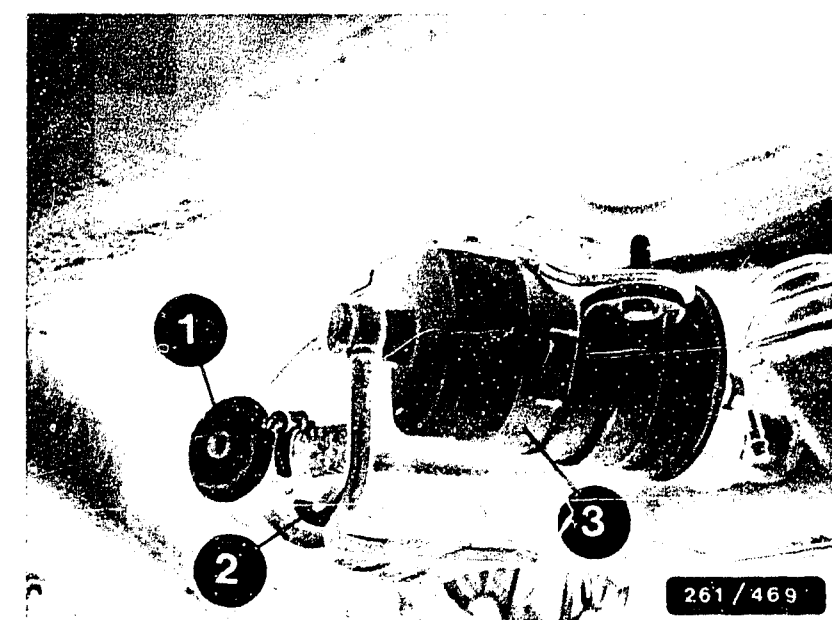


- Leaks at pressure side?
Check fuel-pressure lines.
- Pressure regulator defective → replace.
- Electric fuel pump mechanically O.K.?



1 = Fuel-pressure regulator
2 = Throttle-valve gap

Illustration: Scorpio
2 = Fuel pump



Throttle valve correctly set?

no

- Loosen hose clamps, disconnect intake-air hose and check throttle-valve gap (pos. 2 in upper illustration) (observe manufacturer's instructions).

- If engine hunts, slightly increase throttle-valve gap.

Note:

Afterwards, reset throttle-valve potentiometer.

- Under full throttle, throttle valve must be fully open (check throttle cable).

yes

yes

Continued on next micropicture

D11

Component testing

Ford



D12

Component testing

Ford



Check idle actuator

1. Measure winding resistance directly at idle actuator (disconnect plug):
8...16 Ω
2. Check for continuity in leads from control unit to idle actuator.
3. Slider of idle actuator must not jam or get stuck.

Winding resistance, slider and leads O.K.?

yes

Throttle-valve potentiometer and relevant cables O.K.?

yes

Continued on next micropicture

no

- Winding resistance outside tolerance:
Exchange idle actuator.
- Check for continuity in lead from control unit term. 21 to idle actuator. Is there battery voltage at other idle-actuator connection? (Switch on ignition and measure to vehicle ground.)
- Actuator mechanically defective, e.g. slider movement sluggish:
Exchange idle actuator.

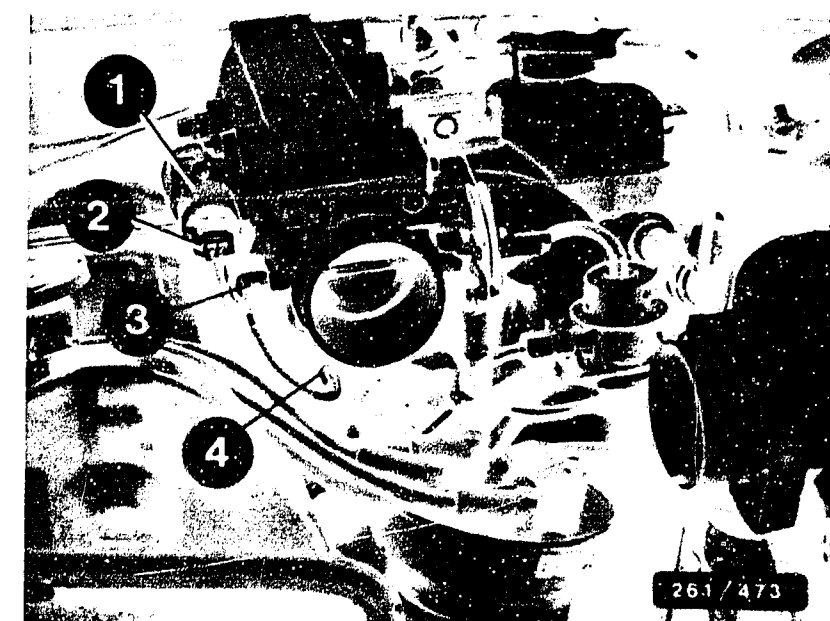
no

- Separate multiple plug and measure using ohmmeter between following connections in plug of potentiometer (see lower illustration):
 - 26 \leftrightarrow 46: 3.2...4.8 k Ω
 - 47 \leftrightarrow 46 with throttle valve closed:
600...750 Ω

When throttle valve opens, resistance rises up to:

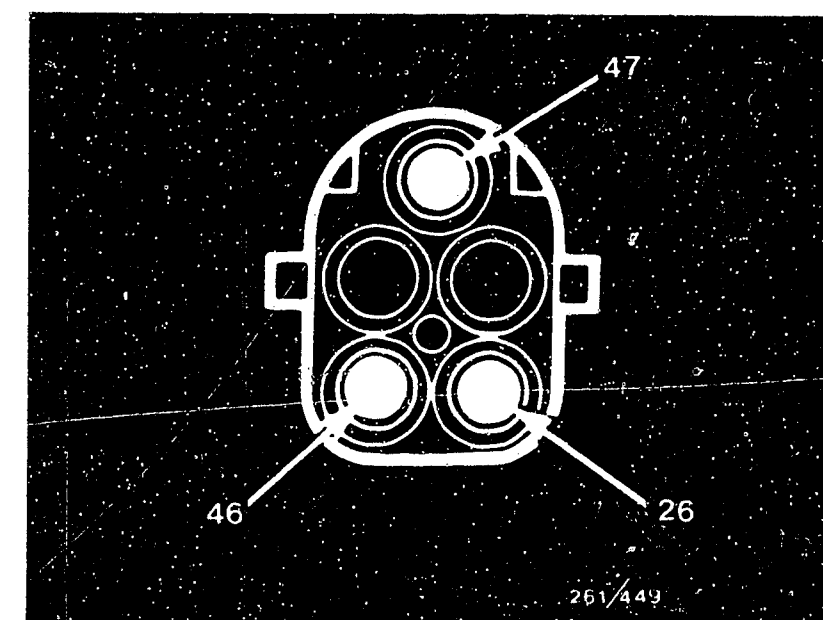
3.5...4.0 k Ω

- Check leads from control unit to potentiometer for continuity, as well as connector plug.



- 1 = Idle actuator
2 = Electrical connection of actuator
3 = Throttle-valve potentiometer
4 = Multiple plug of throttle-valve potentiometer

Illustration = Multiple plug of throttle-valve potentiometer (Top view)



Air-flow sensor O.K.?

no

Testing:

Unscrew air-flow sensor from air-filter housing and if nec. loosen hose clamp. Open air-flow sensor flap manually; it must open smoothly and easily up to stop and close again of own accord up to stop.

Air-flow sensor flap must not get stuck when opening. Look for traces of grinding. Clean inside of very dirty air-flow sensor and polish using a lint-free cloth. If traces of grinding present, replace air-flow sensor. Disconnect connector and connect ohmmeter to following terminals of air-flow sensor in turn.

Measure resistance values (see illustration a below):

● Term. 9 (26) and term. 6 (46):
max. 2.5 k Ω

● Term. 7 (43) and term. 6 (46):
50...100 Ω

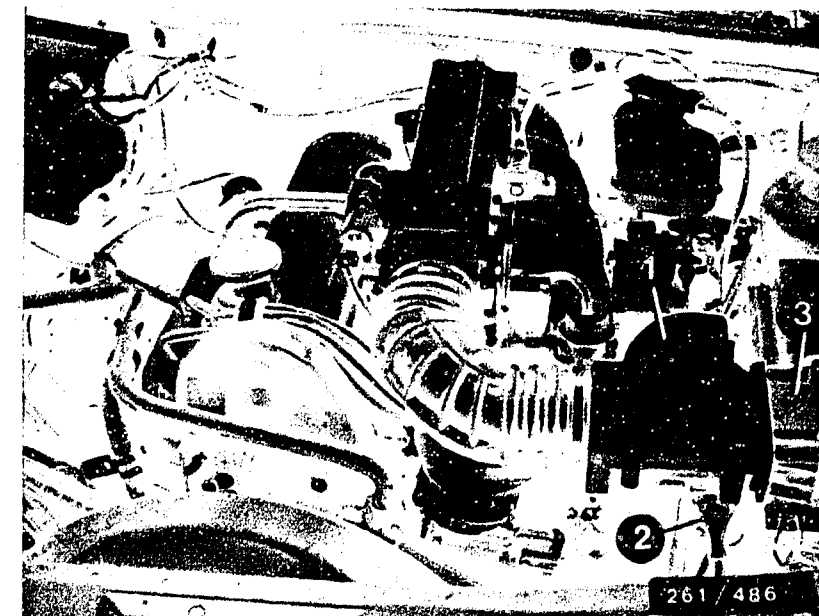
(Air-flow sensor flap in neutral position)

Deflect air-flow sensor flap:

max. 2.1 k Ω

yes

Continued on next micropicture



1 = Air-flow sensor with integral intake-air temperature sensor

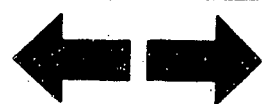
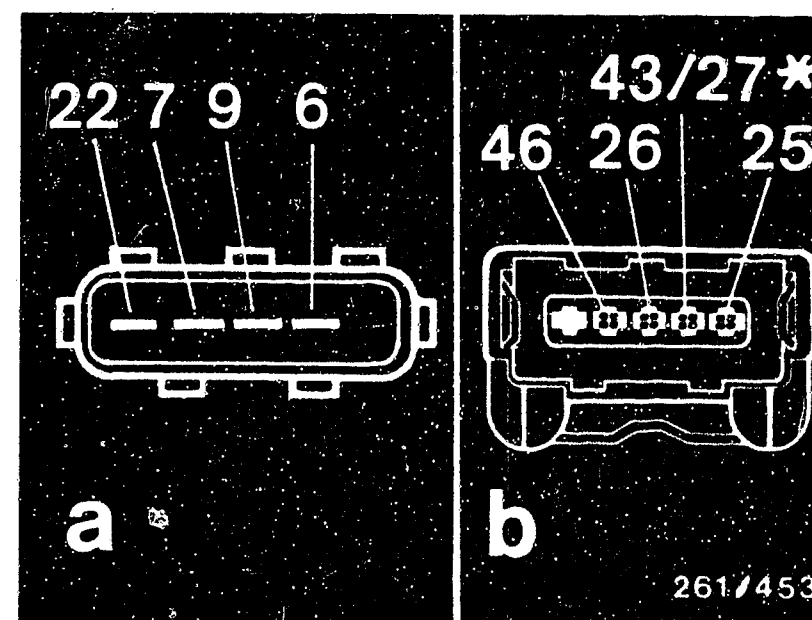
2 = Air-flow sensor plug

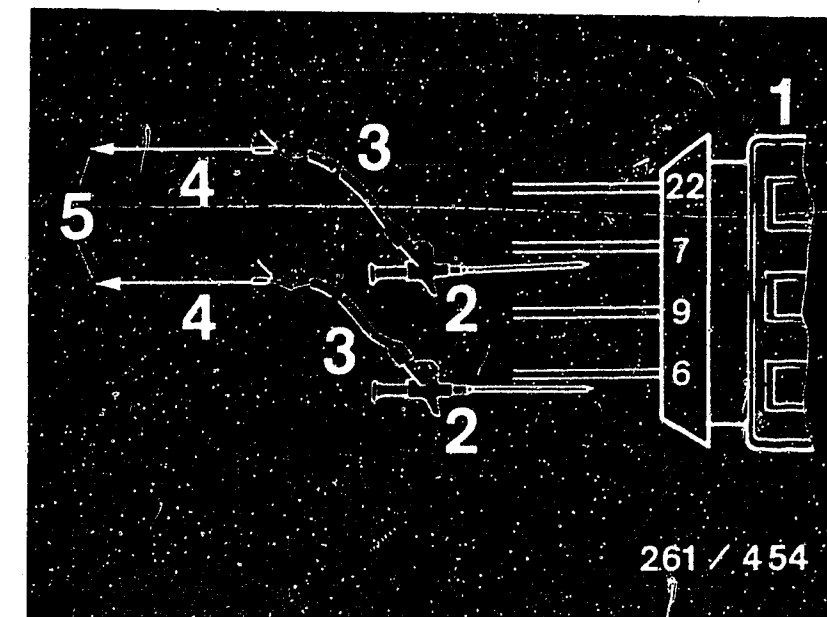
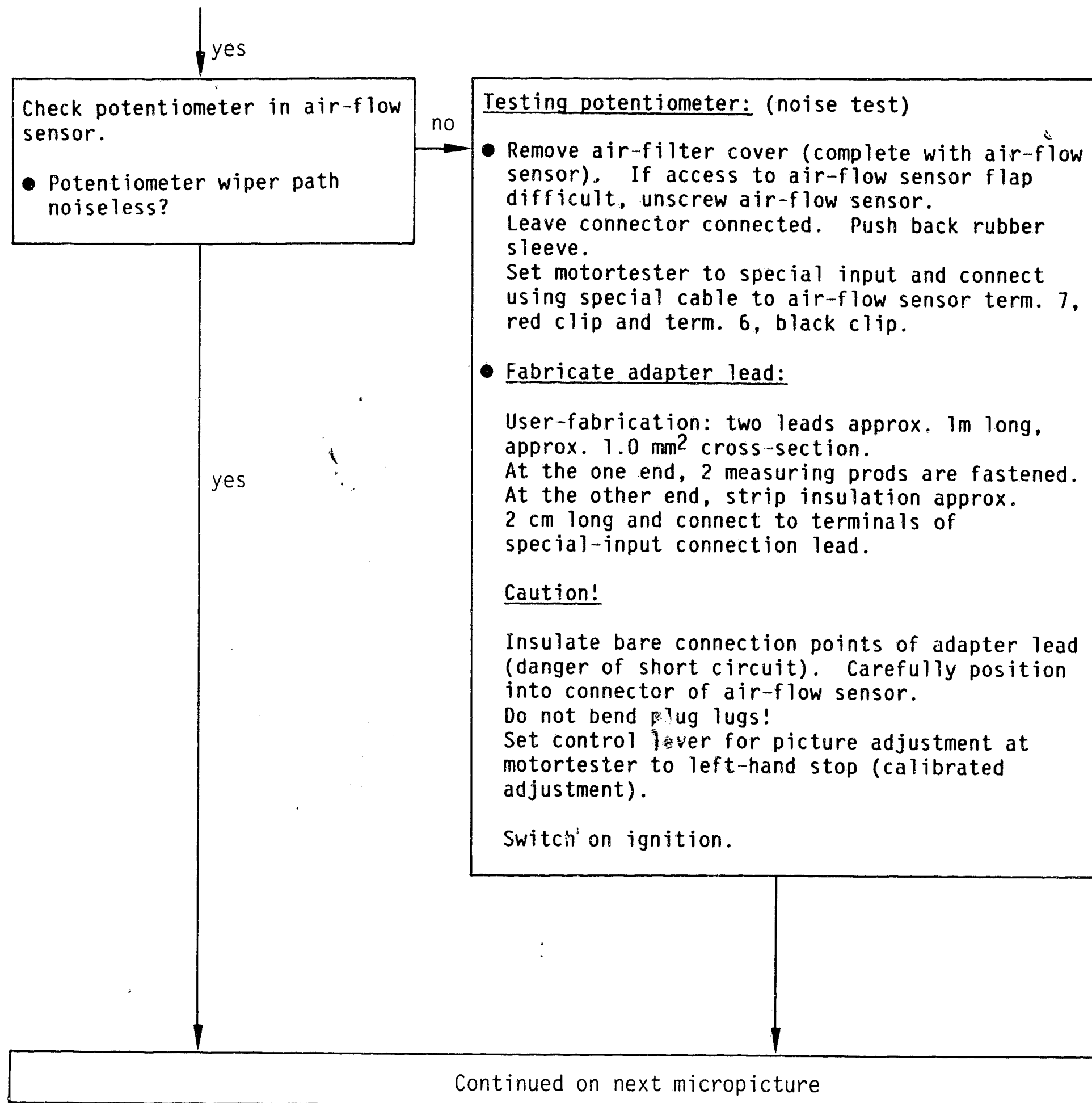
3 = Air-filter housing

a = Electrical connection at air-flow sensor

b = Air-flow sensor plug (top view)

* = Term. 27 instead of 43 for S/CH version



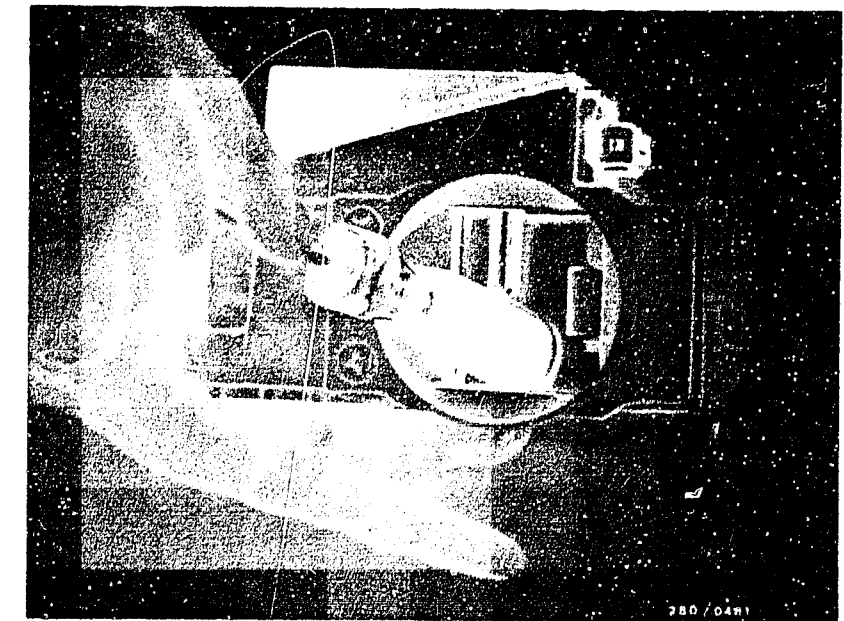


- 1 = Air-flow sensor connector
- 2 = Clamping test prod
- 3 = Adapter lead (user-fabrication)
- 4 = Special-input connection lead
- 5 = Motortester special input



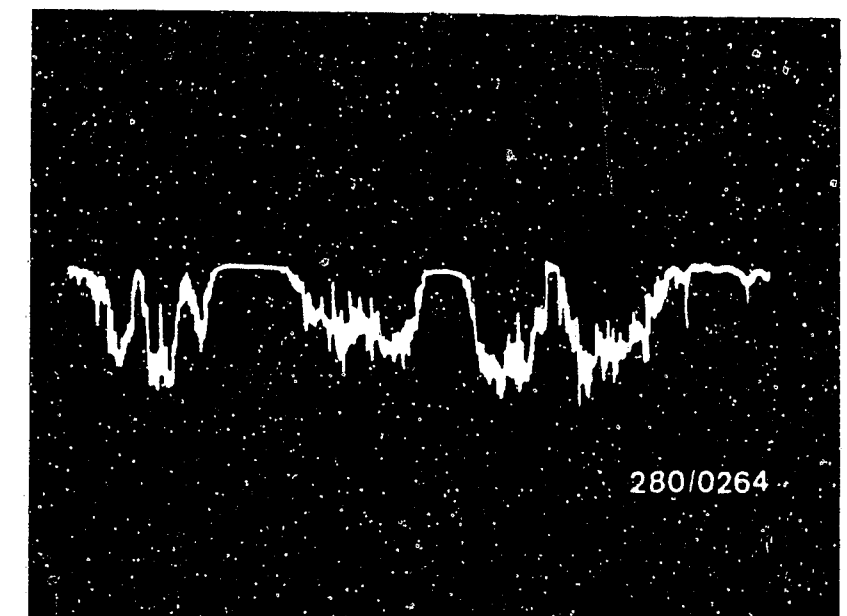
- Abruptly deflect the air-flow sensor flap of air-flow sensor several times. If air-flow sensor O.K., a deviation signal without interruptions must be visible on oscilloscope. If air-flow sensor defective, a noise signal appears similar to that in figure alongside. Replace air-flow sensor. Disconnect adapter lead after test and push on rubber sleeve correctly. Mount air-flow sensor. Push on all hoses and tighten (leaks).

yes



Push air-flow sensor flap in air-flow sensor

Noise signal of defective air-flow sensor



Continued on next micropicture

D 19

Component testing

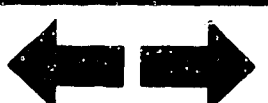
Ford



D 20

Component testing

Ford



yes

Check intake-air temperature sensor (integral in air-flow sensor)

Connect ohmmeter to disconnected control-unit plug term. 25 and term. 46 or directly to air-flow sensor term. 22 and term. 6 (disconnect plug).

See table for resistance values

| Ambient temperature | Resistance values |
|---------------------|-------------------|
| 0°C | 4.4...6.8 kΩ |
| +15...30°C | 1.45...3.3kΩ |
| + 40°C | 0.9...1.3 kΩ |
| + 60°C | 480...720 Ω |
| + 80°C | 280...360 Ω |

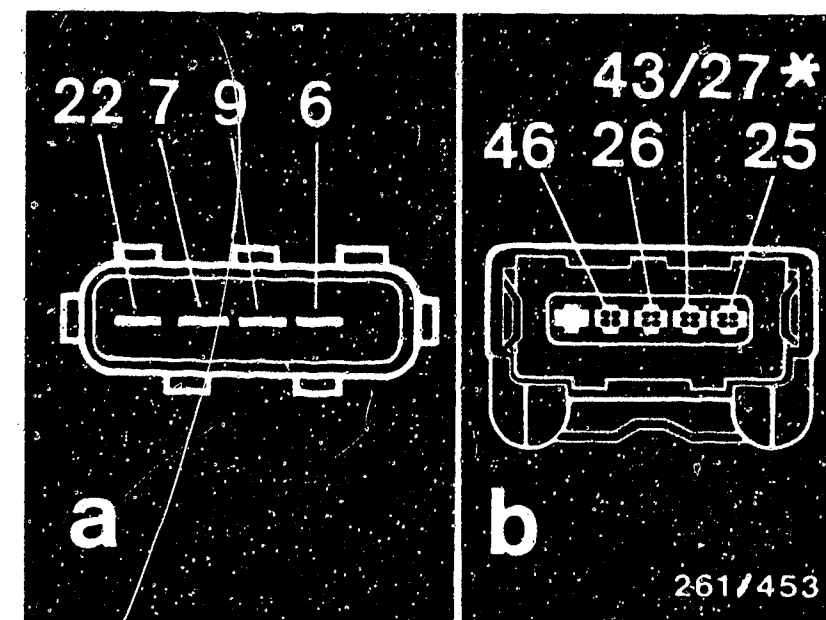
Resistance value at given ambient temperature correct?

yes

Continued on next micropicture

no

1. If ohmmeter indicates $\infty \Omega$, disconnect air-flow sensor plug (see upper illustration) and check for continuity in connection lead. To do this, short circuit connections 25 and 46 in plug using piece of wire and connect ohmmeter to control-unit plug term. 25 and term. 46. Reading 0...1 Ω , otherwise eliminate short circuit and/or contact resistance.
2. If resistance value different, replace air-flow sensor.

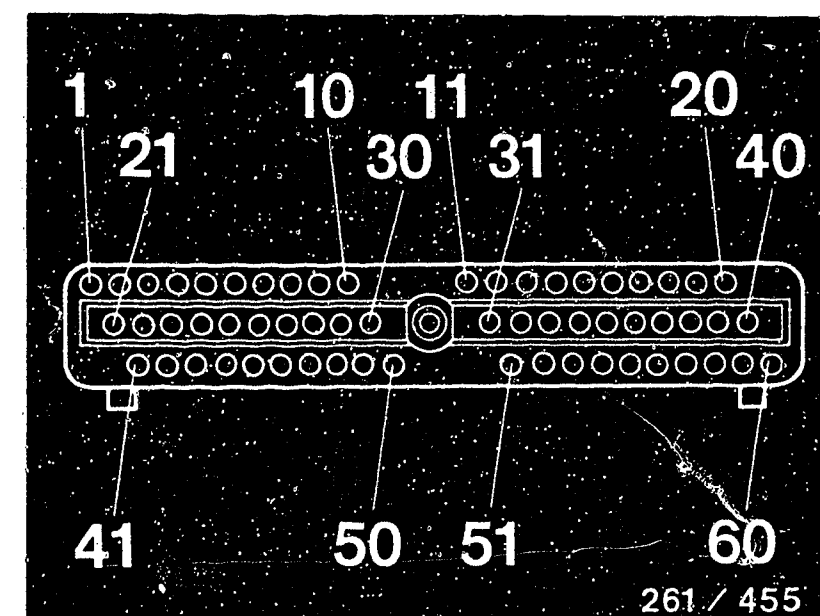


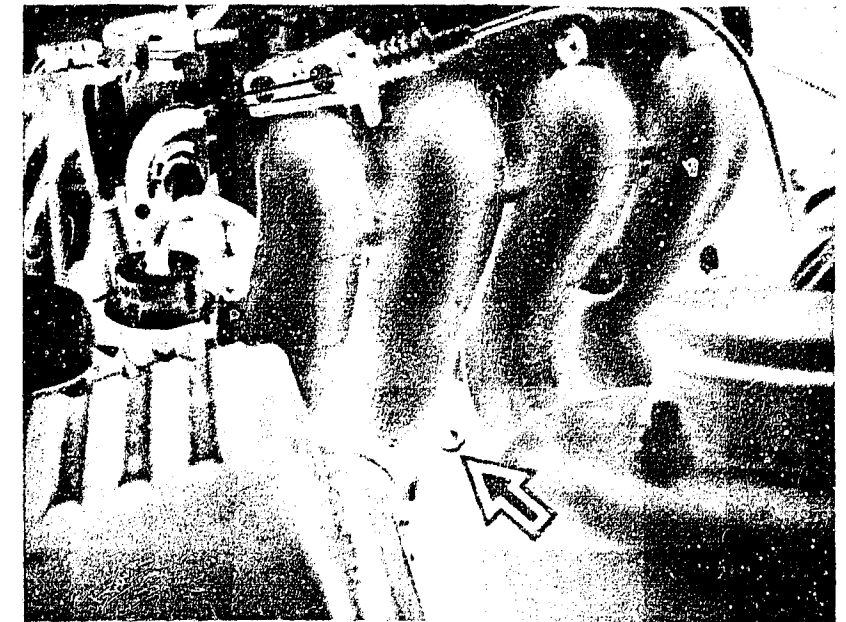
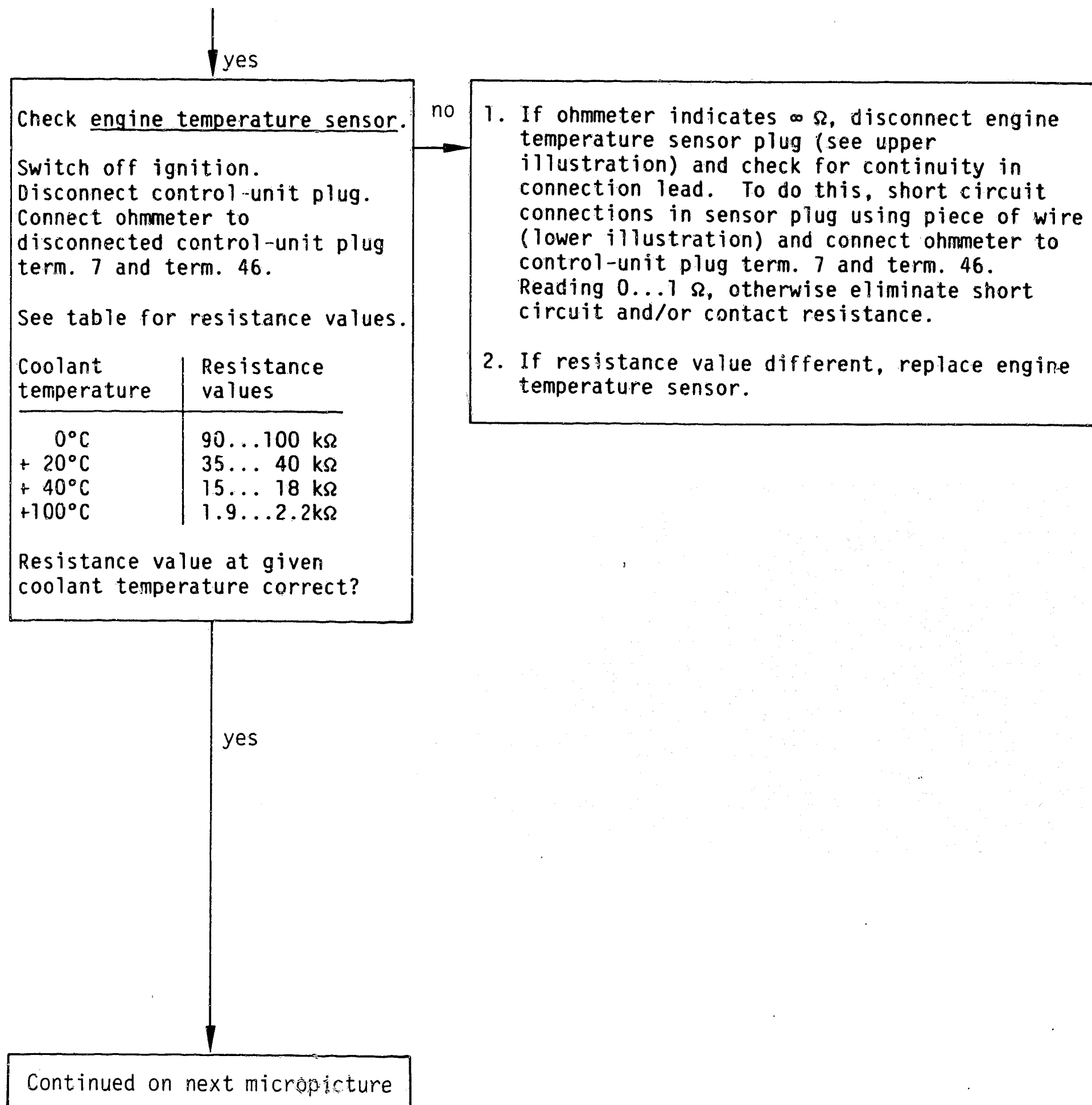
a = Electrical connection at air-flow sensor

b = Air-flow sensor plug (top view)

* = Term. 27 instead of 43 for S/CH version

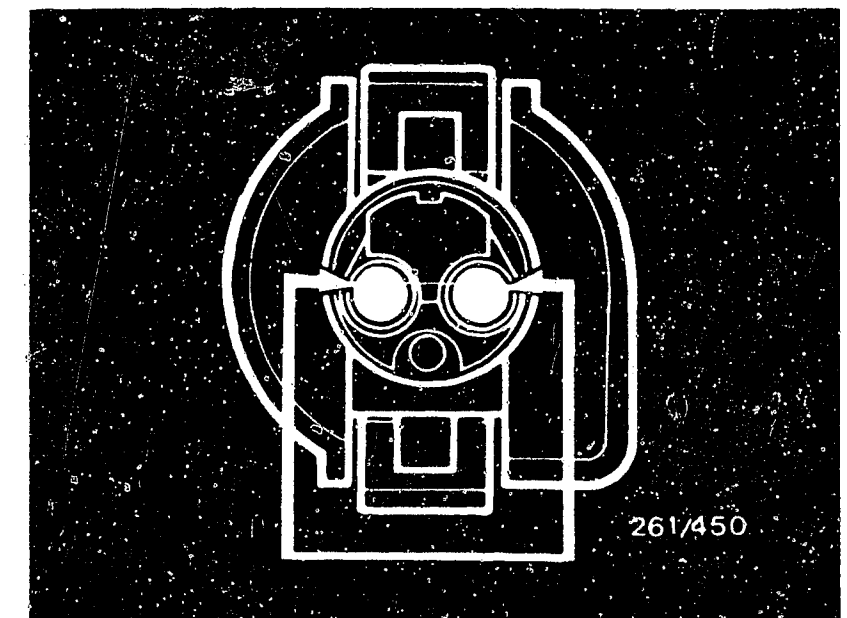
Illustration: 60-pin EEC IV control-unit plug (top view)





Arrow= Engine temperature sensor

Engine temperature sensor plug (top view)



yes

Check ignition coil.
Resistance of primary winding
(term. 15 and term. 1):
0.68...0.91 Ω (take
resistance of test lead and
test prods into account).

Resistance of secondary winding
(term. 4 and term. 1):
4.3...7.3 k Ω .

Resistance values O.K.?

Plug (arrow - lower
illustration) present and/or
sealing compound escaped?

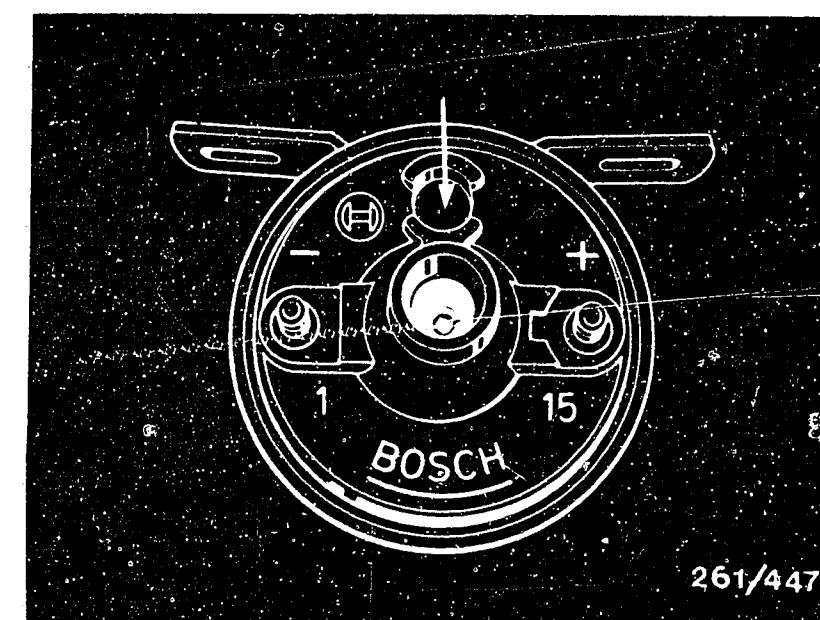
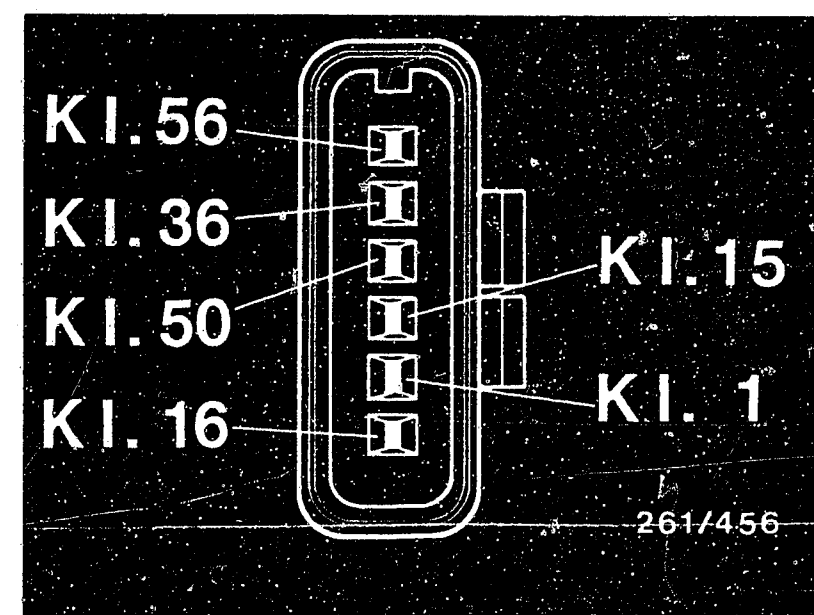
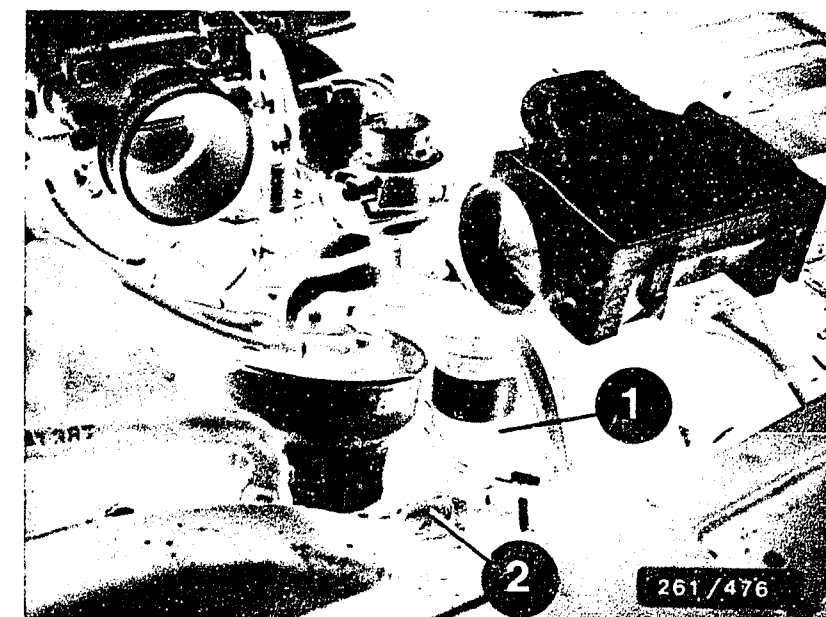
no

1. If plug is not in position and/or sealing
compound has escaped, replace ignition coil (1)
and ignition module (2) (upper illustration),
and check for continuity (approx. 0 Ω) in
lead from ignition coil term. 1 to
ignition-module plug (center illustration).

2. Replace ignition coil, if resistance values
outside tolerance.

yes

Continued on next micropicture



E1

Component testing

Ford

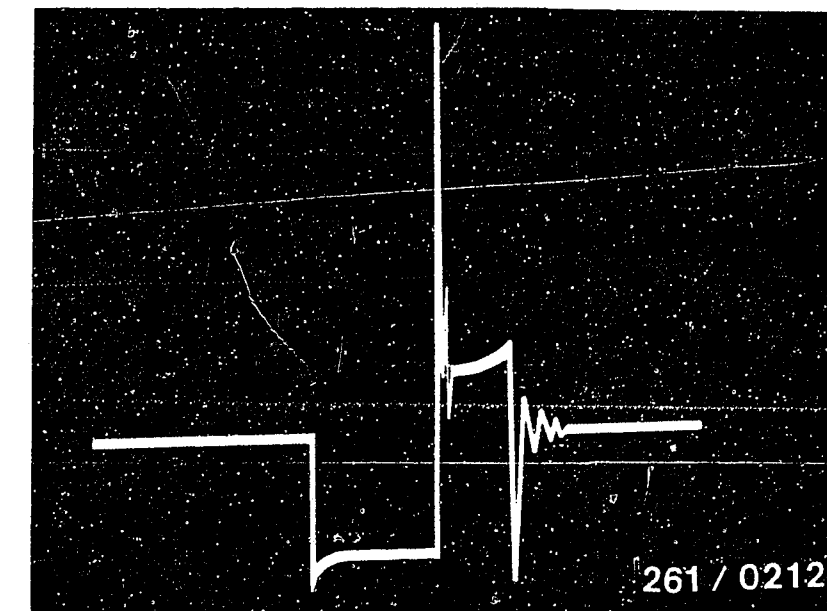
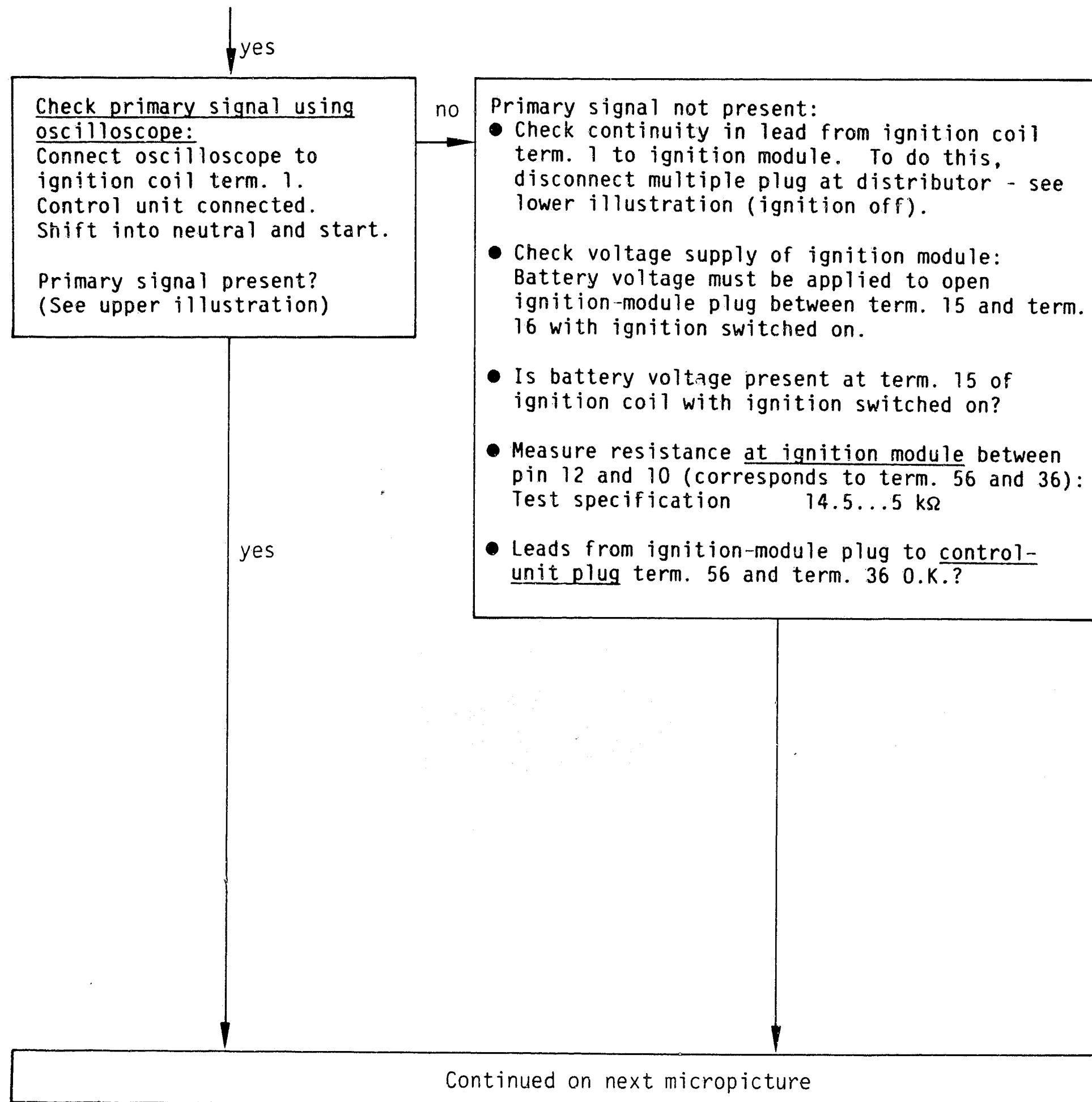


E2

Component testing

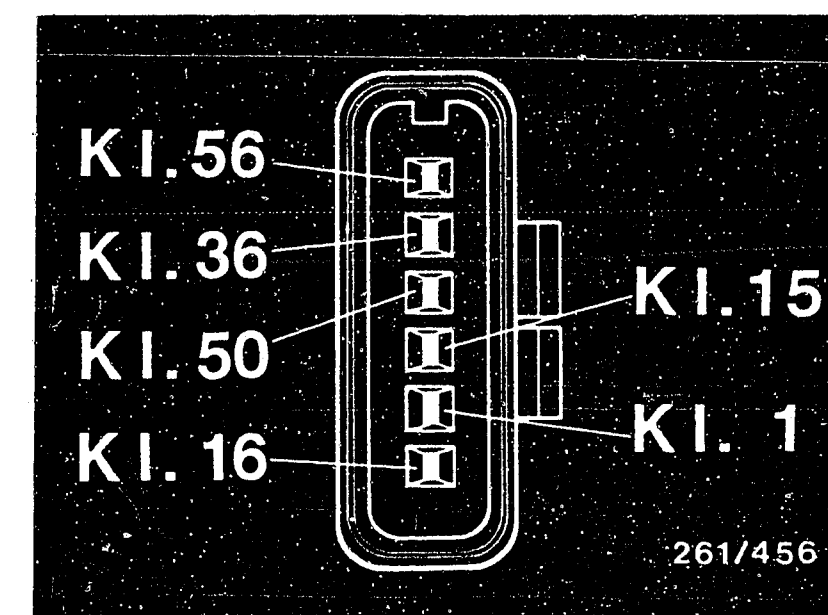
Ford





Primary signal at ignition coil term. 1

6-pin plug to ignition module (top view)



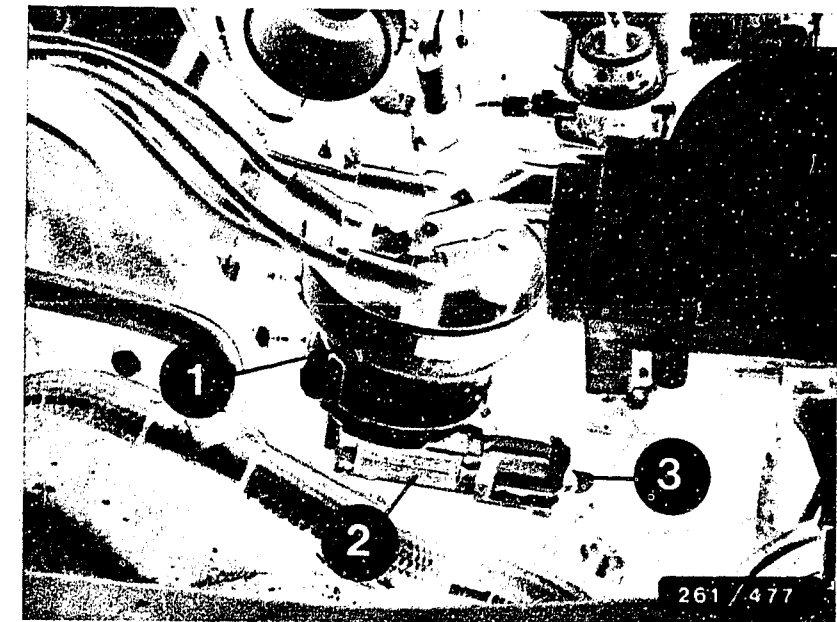
- Check Hall generator.
Control-unit plug and ignition-module plug connected.
Crank engine for 5 s long and measure voltage at back of control-unit plug between term. 37 (+) and term. 56 (-).

Test specification: 4...7 V

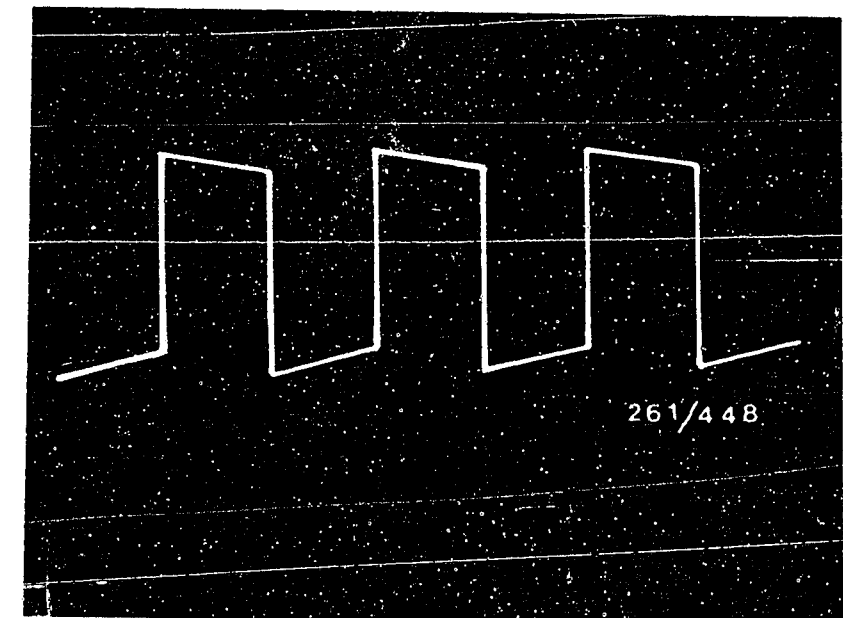
- Check control unit (ignition signal):
As above, however check voltage curve at term. 37 (+) to term. 56 (-) using oscilloscope (special input).
Result: roughly a rectangular signal (see lower illustration).

If no signal, replace control unit.
Requirement: voltage supply for control unit present, Hall generator and ignition module O.K.

yes



1 = Ignition distributor
2 = Ignition module
3 = 6-pin plug to ignition module



Continued on next micropicture

E5

Component testing
Ford



E6

Component testing
Ford



yes

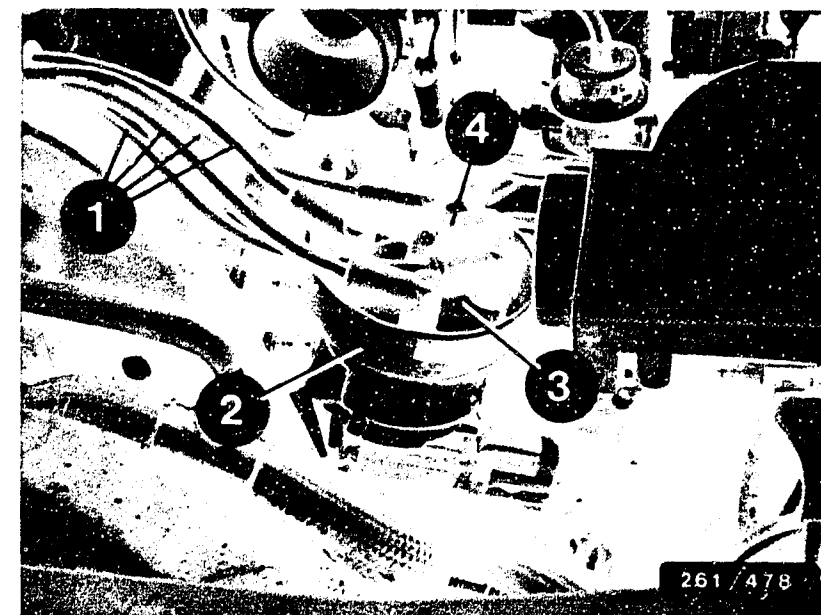
Secondary pattern of all cylinders correct?

no

- Distributor cap oiled-up outside and (or) inside?
Remove distributor rotor and check. Traces of sparks at rotor or distributor cap visible?
- Check interference-suppression resistors, H.T. ignition cables and spark plugs.
Interference-suppression resistors in distributor cap per dome
approx. 1 k Ω
Ignition cables are designed as resistance cables and have resistance of up to 30 k Ω depending upon length of cable.
- When connecting the H.T. ignition cables, pay attention to cylinder numbers. Do not forget shielding cover.

yes

Continued on next micropicture



- 1 = Ignition cable
- 2 = Shielding cover
- 3 = Distributor cap
- 4 = High-voltage cable to ignition coil

E7

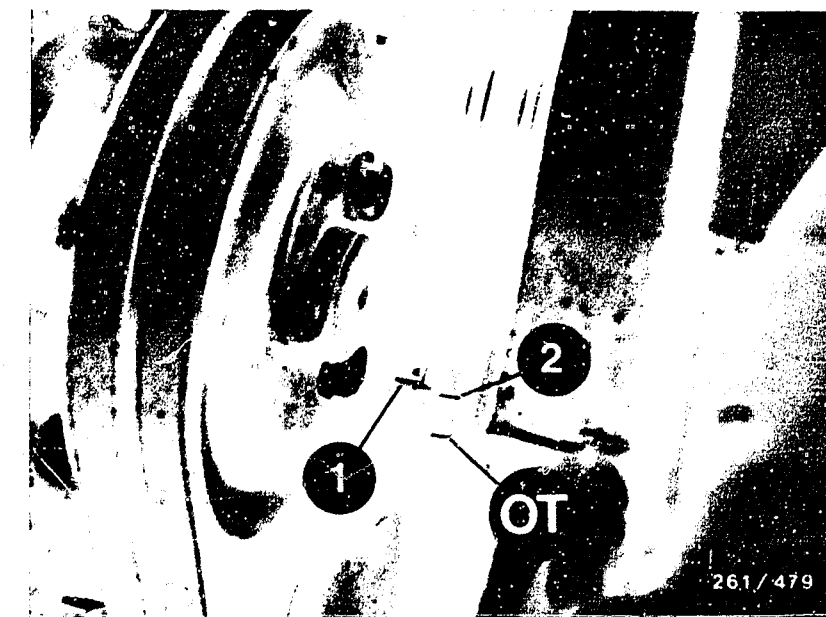
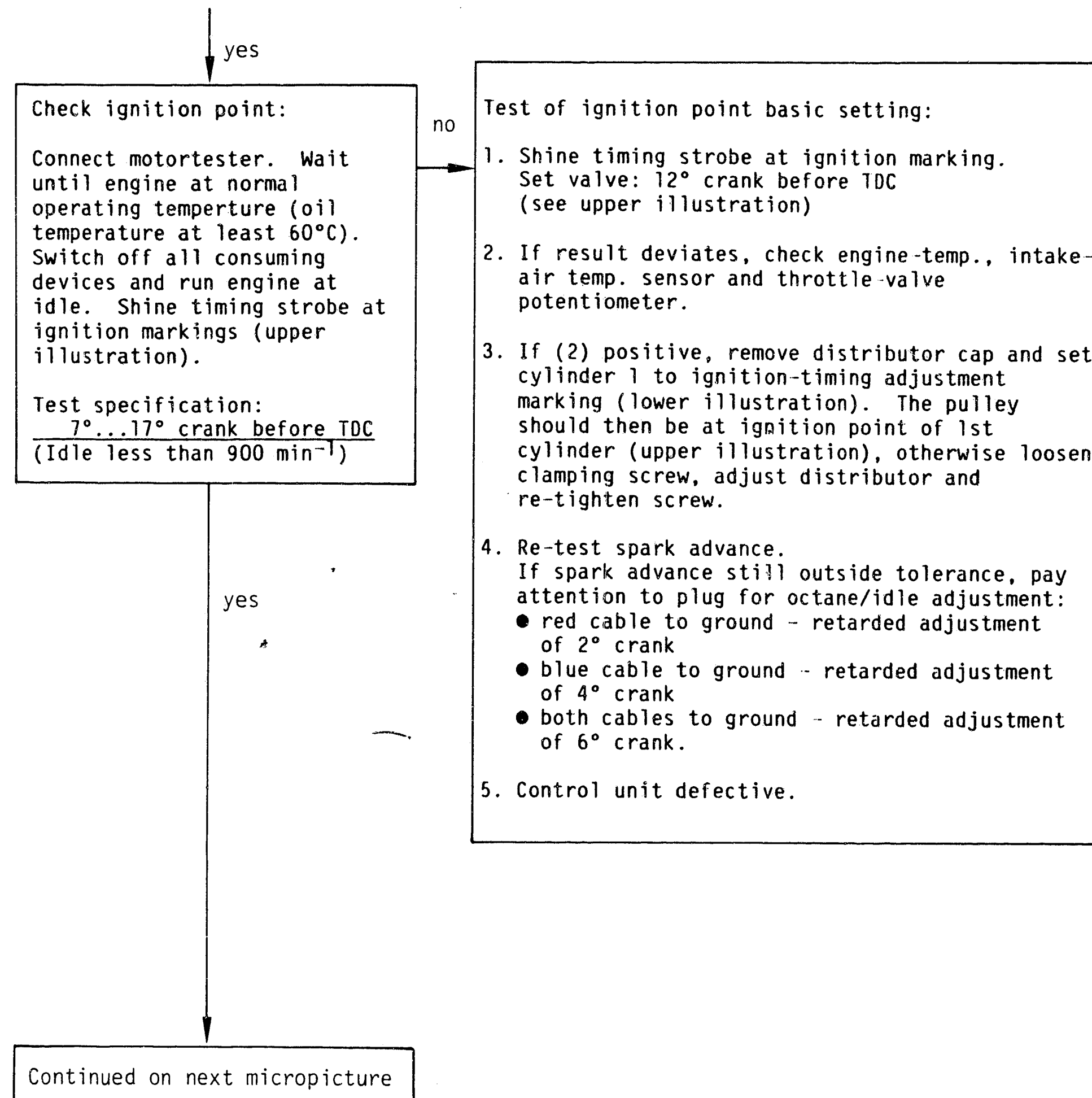
Component testing
Ford



E8

Component testing
Ford

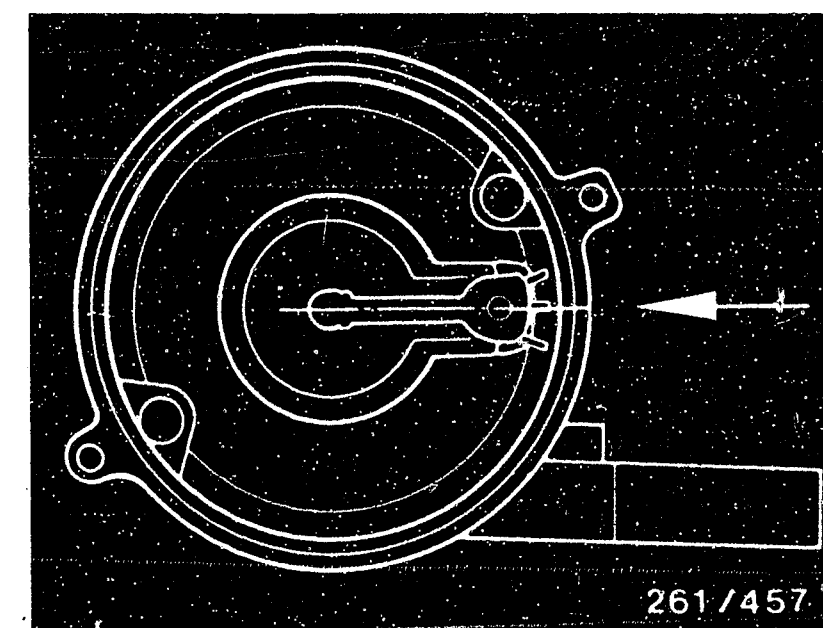




- 1 = Fixed mandrel at engine casing (reference point for ignition-timing adjustment)
- 2 = Movable ignition markings on pulley

Illustration = Rotor position with regard to distributor housing

Arrow = Point of rotor points to marking of cylinder 1



yes

Check air-intake system for leaks.

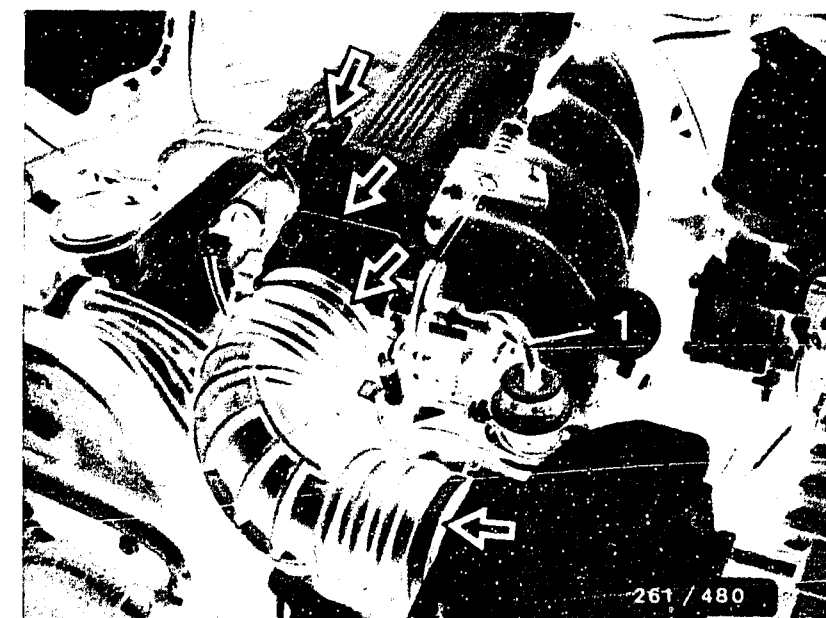
- All hoses correctly connected?
(Visual examination)
- Kinks in hoses or hoses damaged?
- Air-intake system tested for leaks with approx. 0.3 bar overpressure?

no

- Check whether hoses of air-intake system and of fuel-line system correctly connected, no kinks and no damage. If necessary, replace hoses. Eliminate leaks using new seals or by tightening up connection screws.
- Leakage test:
Seal exhaust end pipe. Remove air-filter cover (complete with air-flow sensor) and seal air-flow sensor duct.
Disconnect air hose from pressure regulator and blow air (approx. 0.3 bar overpressure) into intake manifold using compressed-air gun. Open throttle valve fully doing so. Brush over or spray all sealing points with soapy water or leak-detection spray.
Leaks may also occur at the following points at the engine:
Oil dipstick not firmly inserted, defective cover seal of oil filler inlet etc.
Bubble or foam formation indicates leaks.

yes

Continued on next micropicture



Arrows = Sealing points of induction system

1 = Air hose of pressure regulator

E11

Component testing

Ford

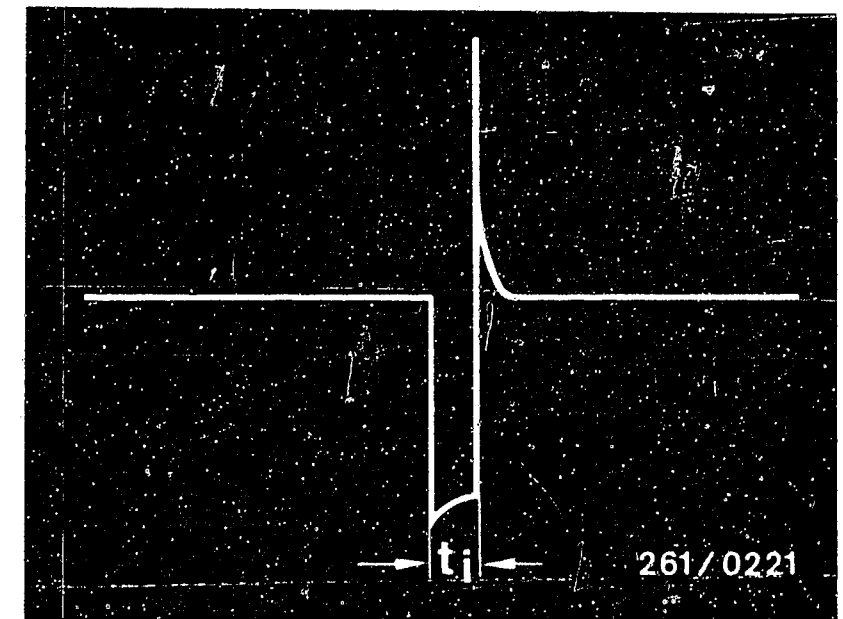
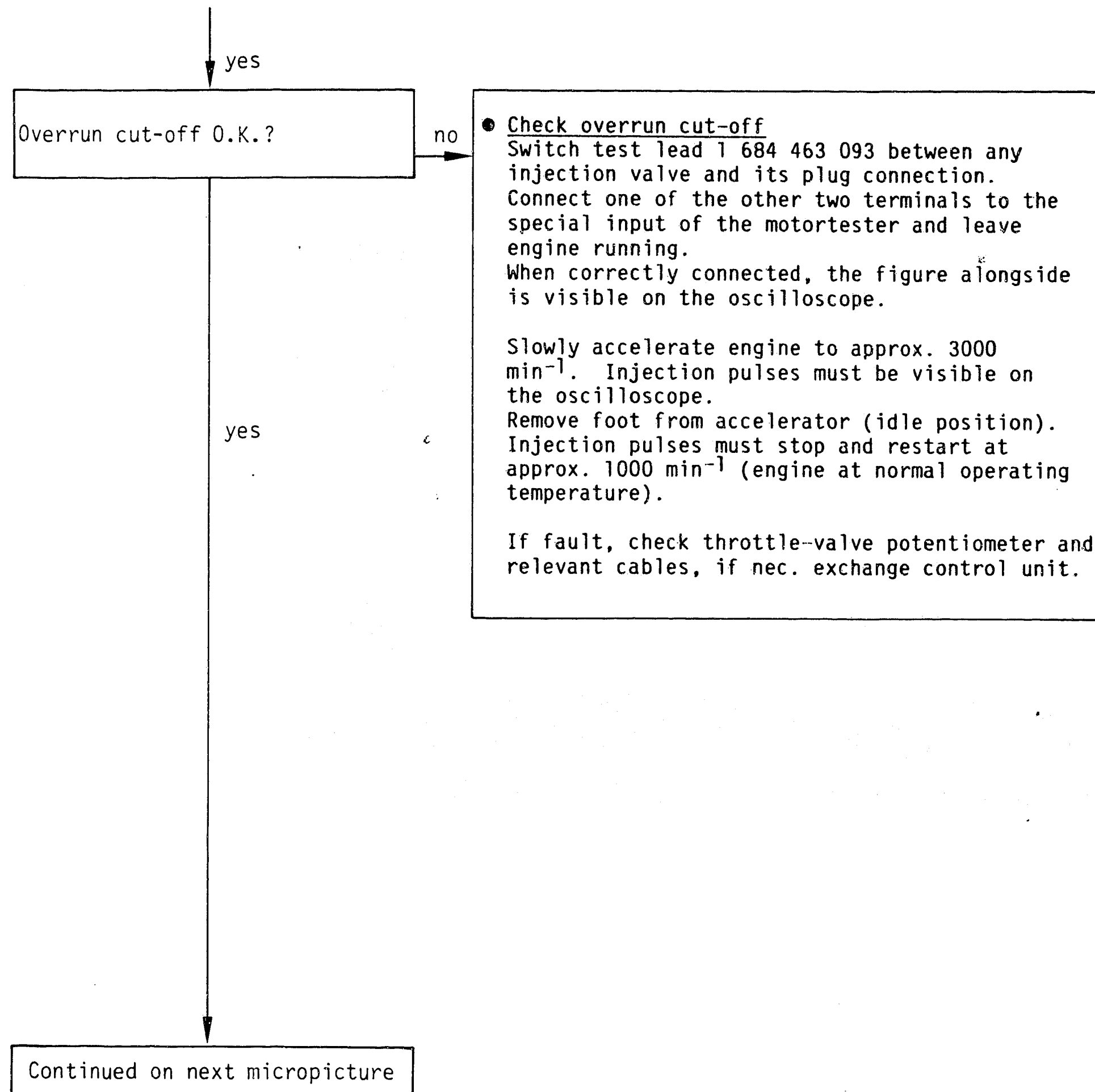


E12

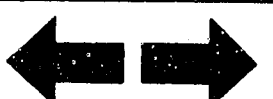
Component testing

Ford





Injection signal



yes

Check idle speed and CO concentration (with engine at norm. op. temp.):

- Idle speed

Manually shifted transmission:
850...900 min⁻¹

Automatic:

775...825 min⁻¹

(Selection lever in position P)

- CO concentration

0.5...1.0% by vol.
at idle speed

Note:

In vehicles with Pulsair system, loosen hose clamp at air-filter housing before CO measurement (see lower illustration). Disconnect air hose and seal.

no

- The idle speed is controlled by the idle actuator. It cannot be adjusted. The idle actuator is controlled by EEC IV control unit (term. 21). If speed outside tolerance or engine running uneven:
 1. Does throttle valve close? (Throttle cable)
 2. Throttle-valve potentiometer O.K.?
 3. Repeat CO measurement, accelerating engine (norm. op. temp.) 15 s to 3000 min⁻¹, then allow to fall again to idle speed and measure CO within 30 s.
 4. Check air-intake system for leaks (see arrows, upper illustration). Pay attention to air leaks at idle actuator.
 5. Check electrical connection to idle actuator. Pay attention to loose contacts.
 6. Idle actuator mechanically O.K.? Freedom of movement of slider?
 7. Throttle-valve basic setting (observe manufacturer's instructions).

- CO adjustment:

Remove protective cap and adjust idle-mixture-adjusting screw in air-flow sensor until specified CO concentration obtained.



- 1 = Idle actuator
2 = Electrical connection
3 = Throttle-valve potentiometer
4 = Throttle-valve stop screw
5 = Throttle cable
Arrows = Sealing points of induction system

Arrow = Connection (air inlet) for Pulsair system (if present)

yes



Continued on next micropicture

E15

Component testing

Ford



E16

Component testing

Ford



yes

Valid for S/CH version:
Exhaust-gas recirculation (EGR)
O.K.?

no

1. Functional test of exhaust-gas-recirculation valve:

Disconnect vacuum hose from EGR valve and apply vacuum to this (vacuum pump). Idle speed must then fluctuate.
Vacuum must remain roughly constant.

2. Functional test of vacuum converter:

Disconnect vacuum line (outlet) from vacuum converter and connect vacuum pump.
Start engine (norm. op. temp.) and briefly increase speed →
the vacuum must rise.

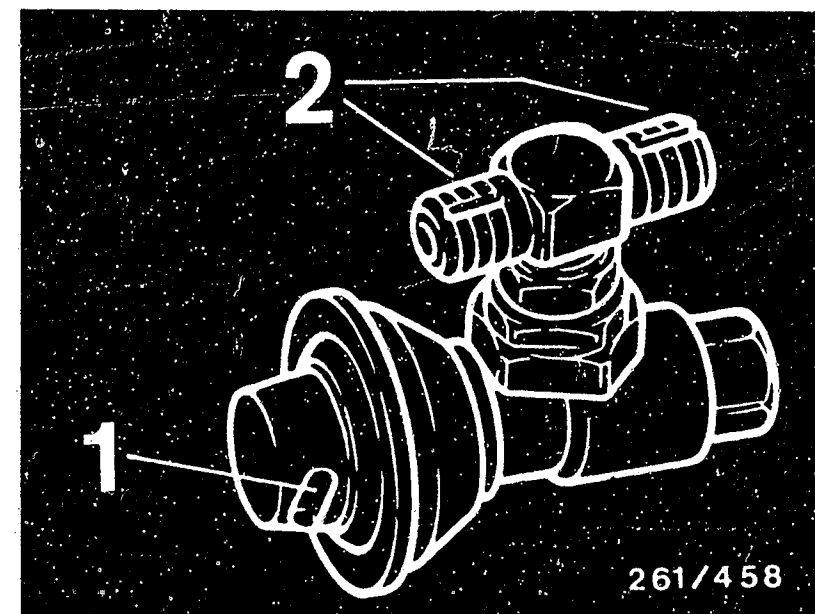
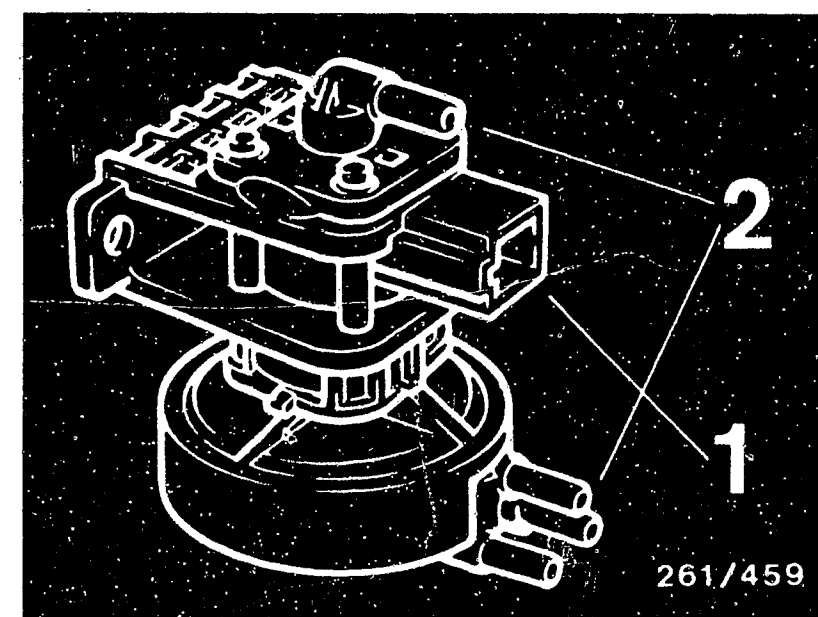


Illustration = EGR valve
1 = Vacuum connection
2 = Exhaust-gas inlet and outlet

Illustration = Vacuum converter
1 = Electrical connection
2 = Vacuum connections



E17

Component testing
Ford



E18

Component testing
Ford



Table of contents

| <u>Section</u> | <u>Coordinates</u> |
|--|--------------------|
| Structure of microcard | A 1 |
| 1. Special features | A 2 |
| 2. Rapid diagnosis chart | A 3 |
| 3. Test specifications | A 12 |
| 4. Diagram of electrical lines | A 14 |
| 5. Diagram of fuel lines | A 22 |
| 6. Test equipment and tools | A 23 |
| 7. Installation position of components | B 1 |
| 8. General information | B 7 |
| 9. Trouble-shooting following customer complaints | C 1 |
| 10. Self-diagnosis | C 5 |



Table of contents (continued)

| <u>Section</u> | <u>Coordinates</u> |
|---|--------------------|
| Component testing | C 8 |
| - Electric fuel pump | C 8 |
| - Emergency program | C 10 |
| - Solenoid-operated injection valves .. | C 14, C 18 |
| - Voltage supply, control unit | C 16 |
| - Fuel pressure | D 1 |
| - Fuel deliveries, electric fuel pump ... | D 9 |
| - Throttle valve | D 11 |
| - Idle actuator | D 13 |
| - Throttle-valve potentiometer | D 13 |
| - Air-flow sensor | D 15, D 17 |
| - Intake-air temperature sensor | D 21 |
| - Engine temperature sensor | D 23 |
| - Ignition coil | E 1 |
| - Primary signal | E 3 |
| - Secondary signal | E 7 |
| - Ignition point | E 9 |
| - Air-intake system, leaks | E 11 |
| - Overrun cut-off | E 13 |
| - Idle speed and CO | E 15 |
| - Exhaust-gas recirculation | E 17 |



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